No L

2-2

K-V-012

JOHN F. KENNEDY
SPACE CENTER

APOLLO/SATURN V

FACILITY DESCRIPTION

VOLUME II OF IV VOLUMES

LAUNCH COMPLEX 39 FACILITY DESCRIPTION

K-V-012

APOLLO/SATURN V
FACILITY DESCRIPTION

VOLUME II OF IV VOLUMES

LAUNCH COMPLEX 39 FACILITY DESCRIPTION

October 1, 1966

APPROVED:

(150-12-0001)

for J. G. Shinkle, Manager
Apollo Program

LIST OF EFFECTIVE PAGES

Insert latest changes; destroy superseded pages.

TOTAL NUMBER OF PAGES IN THIS DOCUMENT IS 124, CONSISTING OF:

Page No.	Issue
i thru x	Original
1-1 thru 1-5	Original
2-1 thru 2-109	Original

FOREWORD

The "Apollo/Saturn V Facilities and GSE Description" document consists of the following volumes:

Volume I	KSC General Industrial Area and Remote Facilities
Volume II	Saturn V Major Facility Description
Volume III	KSC Provided Saturn V GSE System Description
Volume IV	KSC Apollo Facilities and GSE System Description

This document is prepared in accordance with the requirement established by the "KSC Apollo/Saturn V Document Tree," dated October 25, 1966.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

SECTION I
INTRODUCTION

1.1 PURPOSE

This volume provides descriptions of facilities and Ground Support Equipment (GSE) at Launch Complex 39 (LC-39), Kennedy Space Center (KSC).

1.2 SCOPE

This volume describes the facilities located in the assembly and launch areas of LC-39.

1.2.1 ASSEMBLY AREA. The facilities located in the assembly area are specified in Table 1-1. The location of these facilities is shown in Figure 1-1.

Table 1-1. Assembly Area

Facility Title	Facility Number
Sewage Treatment Plant	K6-792
Vehicle Assembly Building	K6-848
Launch Control Center	K6-900
Cooling Tower	K6-945
Utility Annex	K6-947
Elevated Storage Tank	K6-994
Ground Storage Reservoir	K6-995
Paint and Oil Storage	K6-996
Guard House W (Utility Annex)	K6-997
Electric Substation	K6-1141
Corps of Engineers Residence Office	K6-1146
Guard House E	K6-1150
Repeater Station	K6-1193
Contractors Support Building No. 2	K6-1195
Camera Tower No. 1	K6-1200
Launch Equipment Shop	K6-1247
Repeater Building No. 3	K7-89
MSS Park Site Electrical Interface Building	K7-187
Ordnance Storage Facility (Magazine) No. 1	K7-255
Ordnance Storage Facility (Magazine) No. 2	K7-306
Ordnance Storage Facility (Magazine) No. 3	K7-356
Ordnance Storage Facility (Magazine) No. 4	K7-405
Ordnance Storage Facility (Magazine) No. 5	K7-406
Ordnance Storage Facility (Magazine) No. 6	K7-407

Table 1-1. Assembly Area (Continued)

Facility Title	Facility Number
Repeater Building No. 2	K7-422
Converter/Compressor Facility	K7-468
Ordnance Laboratory	K7-506
Guard House	K7-557
Repeater Building No. 1	K7-709
Helium/Nitrogen Storage	K7-853
Barge Terminal Facility	K7-1005
Instrumentation Building	K7-1557

1.2.2 LAUNCH AREA. The facilities located in the launch area are specified in Table 1-2. The location of these facilities is shown in Figure 1-2.

Table 1-2. Launch Area

Facility Title	Facility Number
Pad A	
LOX Facility	J8-1502
Operations Support Building A1	J8-1503
Camera Pad 1	J8-1512
LH_2 Facility	J8-1513
Electrical Equipment Building, LOX	J8-1553
Camera Pad 6	J8-1554
Electrical Equipment Building, RP-1	J8-1563
Foam Building	J8-1564
RP-1 Facility	J8-1613
Operations Support Building A2	J8-1614
Compressed Air Building	J8-1659
Camera Pad 5	J8-1703
Sewage Treatment Plant	J8-1705
Sewage Lift Station	J8-1705A
Sewage Equipment Building	J8-1705B
Launch Pad A	J8-1708
Camera Pad 2	J8-1714
Remote Air Intake	J8-1753
Azimuth Alignment Building	J8-1858
Guard House	J8-1959
Camera Pad 4	J8-1956
Camera Pad 3	J8-1961

Table 1-2. Launch Area (Continued)

Facility Title	Facility Number
Pad B	
Operations Support Building B1	J7-132
LOX Facility	J7-182
Camera Pad 6	J7-183
Camera Pad 1	J7-191
LH_2 Facility	J7-192
Electrical Equipment Building, LOX	J7-231
Electrical Equipment Building, RP-1	J7-241
Foam Building	J7-242
Operations Support Building B2	J7-243
RP-1 Facility	J7-292
Camera Pad 5	J7-331
Launch Pad B	J7-337
Compressed Air Building	J7-338
Camera Pad 2	J7-342
Sewage Treatment Plant	J7-384
Sewage Lift Station	J7-384A
Sewage Equipment Building	J7-384B
Remote Air Intake	J7-432
Azimuth Alignment Building	J7-537
Camera Pad 4	J7-584
Camera Pad 3	J7-589
Guard House	J7-637
Other Facilities	
Repeater Building No. 6	J7-986
Industrial Water Pumping Station	J7-1388
Repeater Building No. 5	J7-1736
Repeater Building No. 4	J8-2204

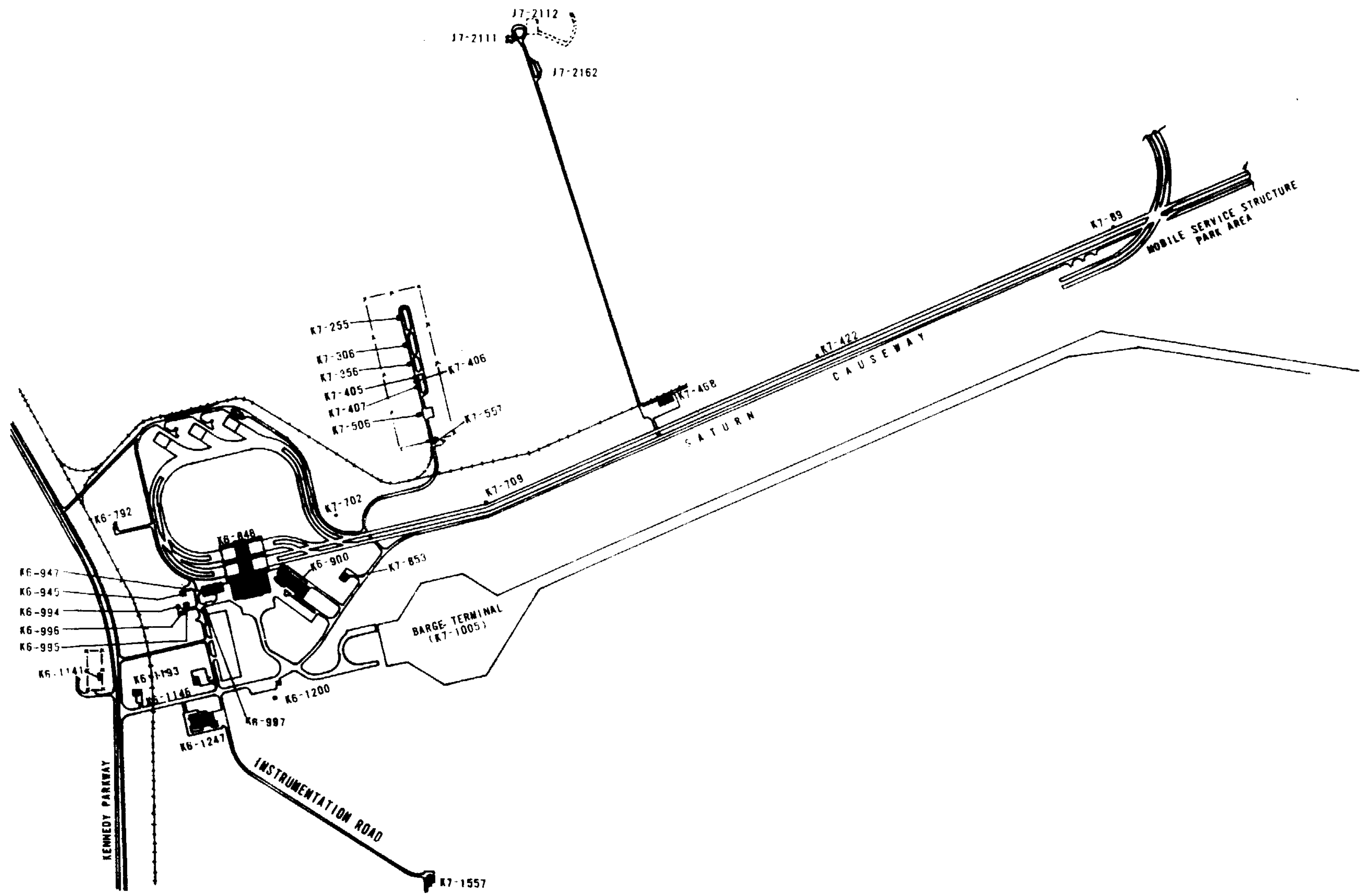


Figure 1-1. Launch Complex 39 Assembly Area

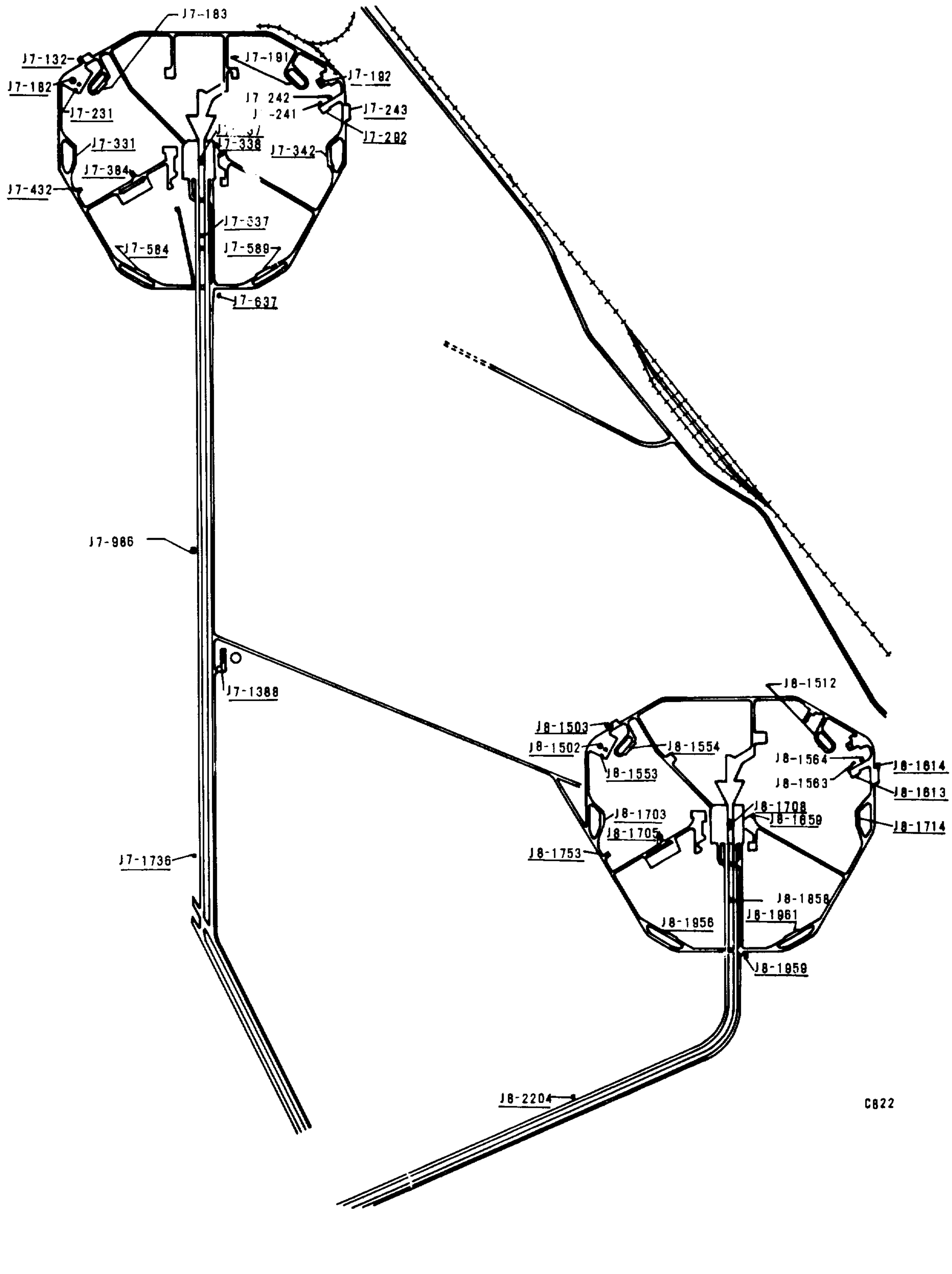


Figure 1-2. Launch Complex 39 Launch Area

SECTION II
LAUNCH COMPLEX 39 FACILITIES

2.1 LAUNCH COMPLEX 39 MOBILE CONCEPT - GENERAL DESCRIPTION

LC-39, the nation's first operational spaceport, ranks as one of history's great engineering achievements. Developed and operated by the Kennedy Space Center, the immense facility is designed to accommodate the massive Apollo/Saturn V space vehicle which will carry American astronauts to the moon.

LC-39 (Figures 2-1 and 2-2) reflects a new approach to launch operations. In contrast to the launch facilities presently utilized at Cape Kennedy, LC-39 permits a high launch rate, economy of operation, and superior flexibility. This new approach, known as the "mobile concept," provides for assembly and checkout of the Apollo/Saturn V vehicle in the controlled environment of a building, its subsequent transfer to a distant launch site, and launch with a minimum of time expended.

The major components of LC-39 include: the Vehicle Assembly Building (VAB), where the space vehicle is assembled and tested; the Launch Control Center (LCC), which houses display, monitoring, and control equipment for checkout and launch operations; the Launch Umbilical Tower (LUT), upon which the space vehicle is erected for checkout, transfer, and launch and which provides internal access to the vehicle and spacecraft during testing; the Crawler/Transporter (C/T), which transfers the space vehicle and LUT to the launch site; the Crawlerway, a specially prepared roadway over which the C/T travels to deliver the Apollo/Saturn V to the launch site; the Mobile Service Structure (MSS), which provides external access to the vehicle and spacecraft at the launch site; and the launch site, from which the space vehicle is launched on Earth orbital and lunar missions.

2.1.1 VEHICLE STAGES. Vehicle stages are shipped by barge from fabrication centers to a turning basin near the VAB, off-loaded onto special carriers, and transported to the VAB. The first stage is towed to the high bay area and erected on the LUT. Four holddown-support arms on the LUT platform secure the booster in place. Work platforms are positioned around the booster for inspection and testing. Concurrently, upper stages of the Saturn V are delivered to the low bay cells, inspected, and tested.

When testing of the individual stages is completed, the upper stages are prepared for mating and moved to the high bay area. All components of the space vehicle, including the Apollo spacecraft, are assembled vertically in the high bay area. The fully assembled space vehicle then undergoes final integrated checkout and simulated flight tests.

2.1.2 LAUNCH UMBILICAL TOWER. The LUT, the key to launch operations at LC-39, actually performs a dual function. It serves as an assembly platform in the VAB and as a launch platform and umbilical tower at the launch site located 3.5 miles away.

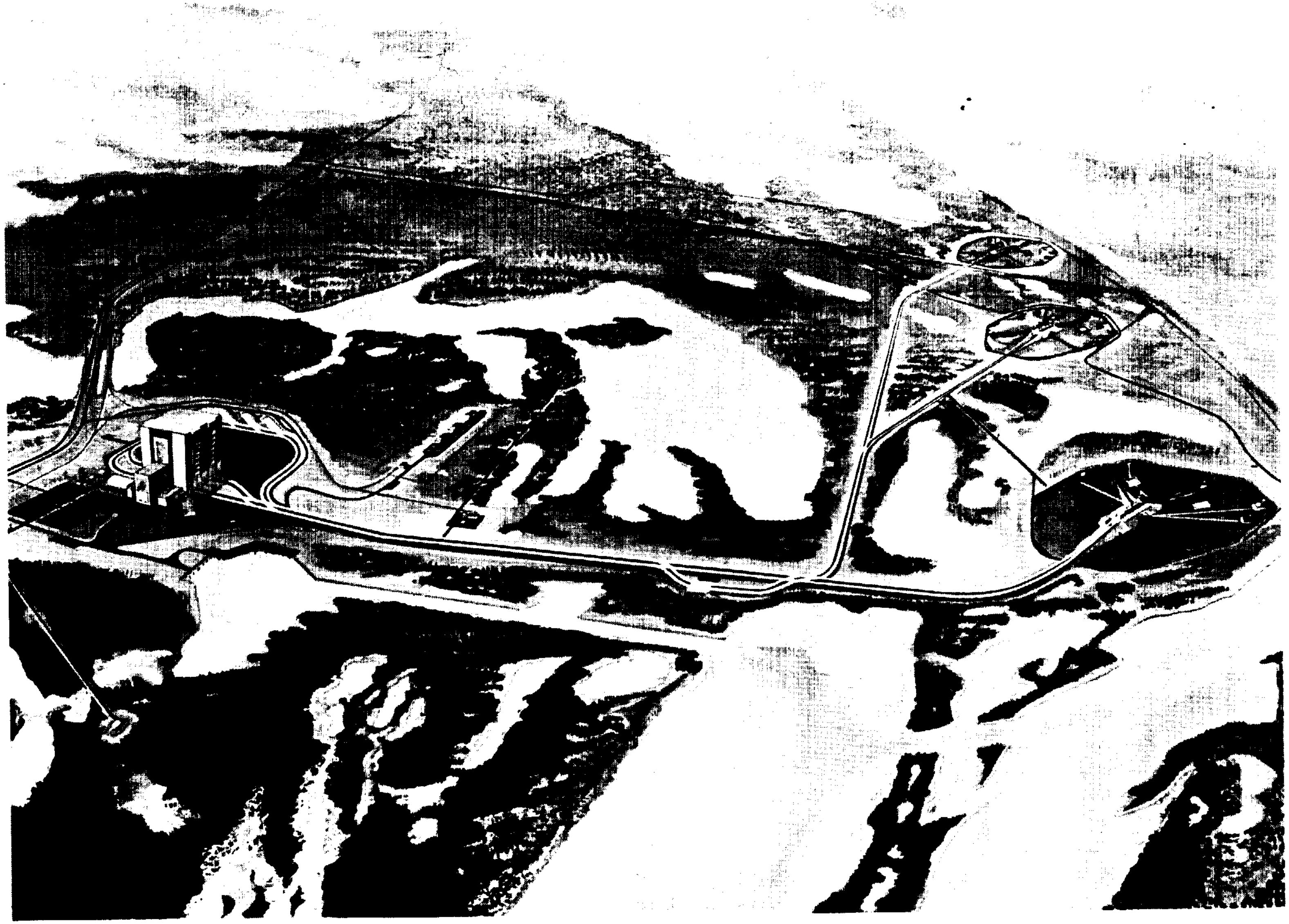


Figure 2-1. John F. Kennedy Space Center, Launch Complex 39 (Concept)

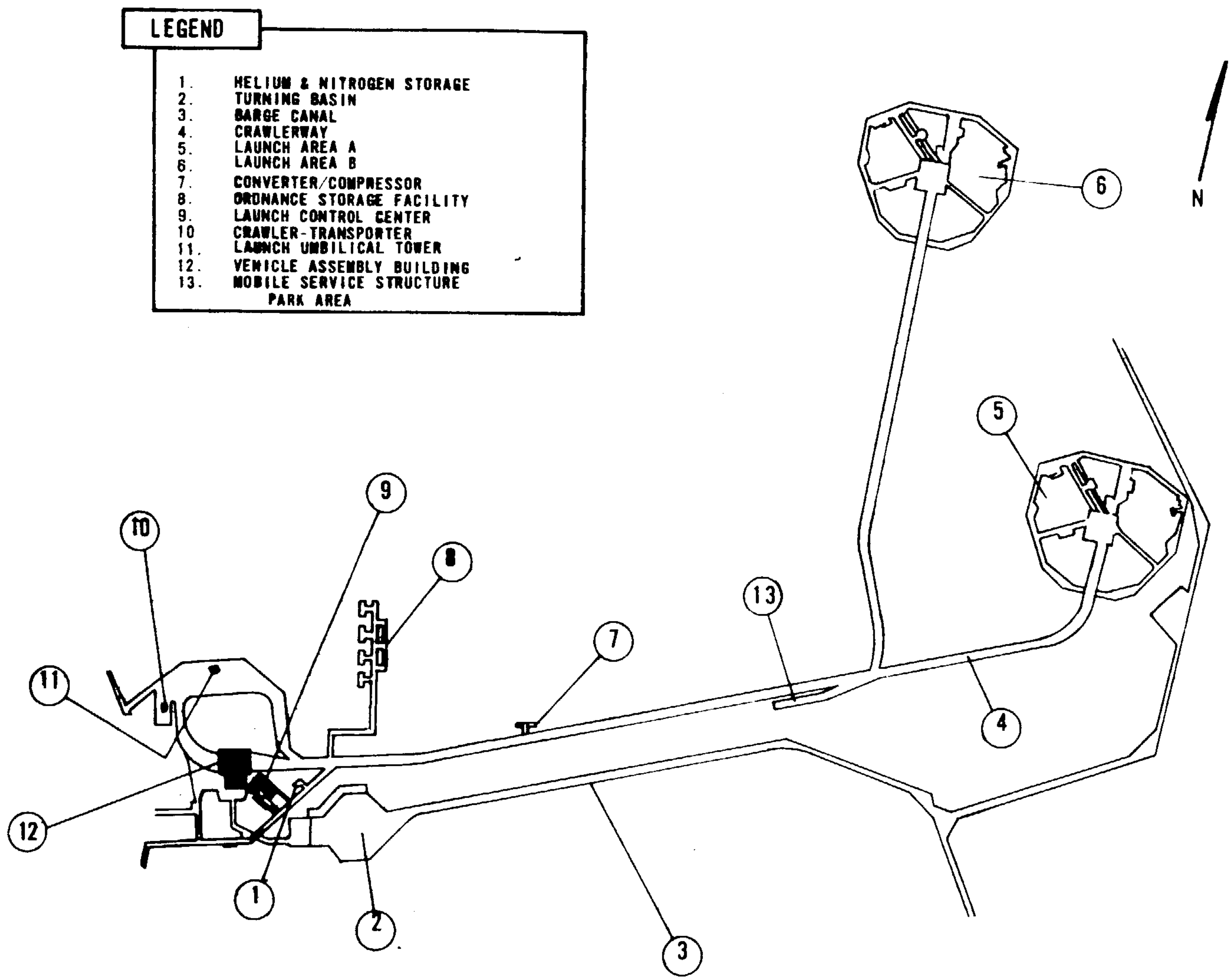


Figure 2-2. John F. Kennedy Space Center, Launch Complex 39

The LUT is a 446-foot-high structure with a base platform measuring 25 feet high, 160 feet long, and 135 feet wide. It weighs 10.6 million pounds. Whether in the VAB, at the launch site, or in the parking area, the LUT is positioned on six 22-foot-high steel pedestals. A 45-square foot opening in the base platform permits passage of engine exhausts at ignition. Three LUTs have been constructed at LC-39.

2.1.2.1 Swing Arms. Nine swing arms extend from the LUT. The topmost arms provide umbilical connections to the space vehicle. These arms are designed to swing rapidly away from the vehicle during launch. Besides carrying vital umbilical lines (propellant, pneumatic, electrical, data link) to the space vehicle, the swing arms also permit a catwalk access to the vehicle during the final phase of countdown.

2.1.2.2 Holddown Arms. The Apollo/Saturn V space vehicle is positioned on the LUT and secured by four support and holddown arms. At the pad these arms hold the vehicle during thrust buildup of the engines.

2.1.3 CRAWLER/TRANSPORTER. A tracked vehicle known as the C/T moves the 36-story Apollo/Saturn V space vehicle and LUT from the VAB to the launch site. Two have been constructed and are stationed at LC-39.

The C/T is similar to machines used in strip mining operations. Weighing approximately 6 million pounds, it is 131 feet long and 114 feet wide. Its height is adjustable from 20 to 26 feet. The vehicle moves on four double-tracked crawlers, each 10 feet high and 40 feet long. Each shoe of the crawler track weighs about a ton. There are 57 shoes on each track and a total of 8 tracks on the entire vehicle.

Two main drive diesel engines provide 5,500 horsepower. Two other diesels generate 2,130 horsepower for leveling, jacking, steering, lighting, ventilating, and electronic systems. Auxiliary generators provide power to the LUT when carried by the C/T.

In operation, the C/T moves under the LUT while inside the VAB. Its 16 hydraulic jacks raise the LUT, with the space vehicle aboard, from support pedestals. The loaded crawler then backs out of the VAB and transports the 11.5 million pounds 3.5 miles to the launch site.

The C/T has a speed of one mile per hour when fully loaded and twice that when unloaded. It can negotiate curves of 500 feet mean radius. A leveling system provides the capability to maintain the entire load in level position during the transfer operation.

The combined weight of the C/T, the LUT, and the Apollo/Saturn V exceeds 17 million pounds at the time of transfer from the VAB to the launch site. To accommodate this load, a specially constructed Crawlerway is provided.

2.1.4 CRAWLERWAY. The Crawlerway extends from the VAB to the launch site, and consists of two 40-foot-wide lanes separated by a 50-foot-wide median strip. The overall width of the Crawlerway is 130 feet or about equal to an eight-lane parkway.

Unsuitable material was removed from the roadbed before beginning construction of the Crawlerway. The area then was compacted with hydraulic fill and selected materials, topped with crushed graded limerock, paved with asphalt, sealed, and covered with gravel, forming a roadbed approximately seven feet thick.

2.1.5 LAUNCH SITES. Two launch sites are located at LC-39, approximately 3.5 miles from the VAB. Each site is an eight-sided polygon measuring 3,000 feet across.

The major elements of the launch sites include the launch pads; storage tanks for liquid oxygen, liquid hydrogen, and RP-1 propellants; gas compressor facilities; and associated umbilical connection lines necessary for launching the space vehicle.

2.2 VEHICLE ASSEMBLY BUILDING (K6-848)

2.2.1 FUNCTION. The VAB (Figures 2-3 and 2-4) provides a protected environment for: the attachment of flight hardware; checkout of the Saturn V propulsion stages and Instrumentation Unit; erection of the vehicle stages and spacecraft in a vertical position on the LUT; and prelaunch pad checkout of the assembled space vehicle.

2.2.2 LOCATION. The VAB is located 5 miles north of the KSC Industrial Area and adjacent to Kennedy Parkway.

2.2.3 GENERAL DESCRIPTION. The VAB is a totally enclosed structure covering 8 acres of ground. It is approximately 525 feet high, 518 feet wide, and 716 feet long. The principle operational elements of the VAB are the low bay area and high bay area. The high and low bay areas are separated into equal segments by a transfer aisle.

The VAB is constructed of structural steel with insulated aluminum siding. Translucent fiberglass sandwich panels form a part of the wall of the north and south elevations.

Office, laboratory, and storage areas are available in the VAB. In addition to highway and marine facilities, the VAB is served by a spur from the Florida East Coast Railway mainline.

2.2.4 LOW BAY AREA. The low bay area (Figure 2-5) provides the facilities for receiving, uncrating, checkout, and preparation of the S-II stage, S-IVB stage, and the Instrument Unit.

The low bay area is located in the southern section of the VAB.

The low bay area is approximately 210 feet high, 442 feet wide, and 274 feet long. There are eight stage preparation and checkout cells, four of which are equipped with systems to simulate interface operations between stages and the Instrumentation Unit. Only the low bay checkout cells are ventilated. Office and laboratory areas are maintained, in summer, to 75 degrees ± 2 degrees Fahrenheit Dry Bulb (FDB) and

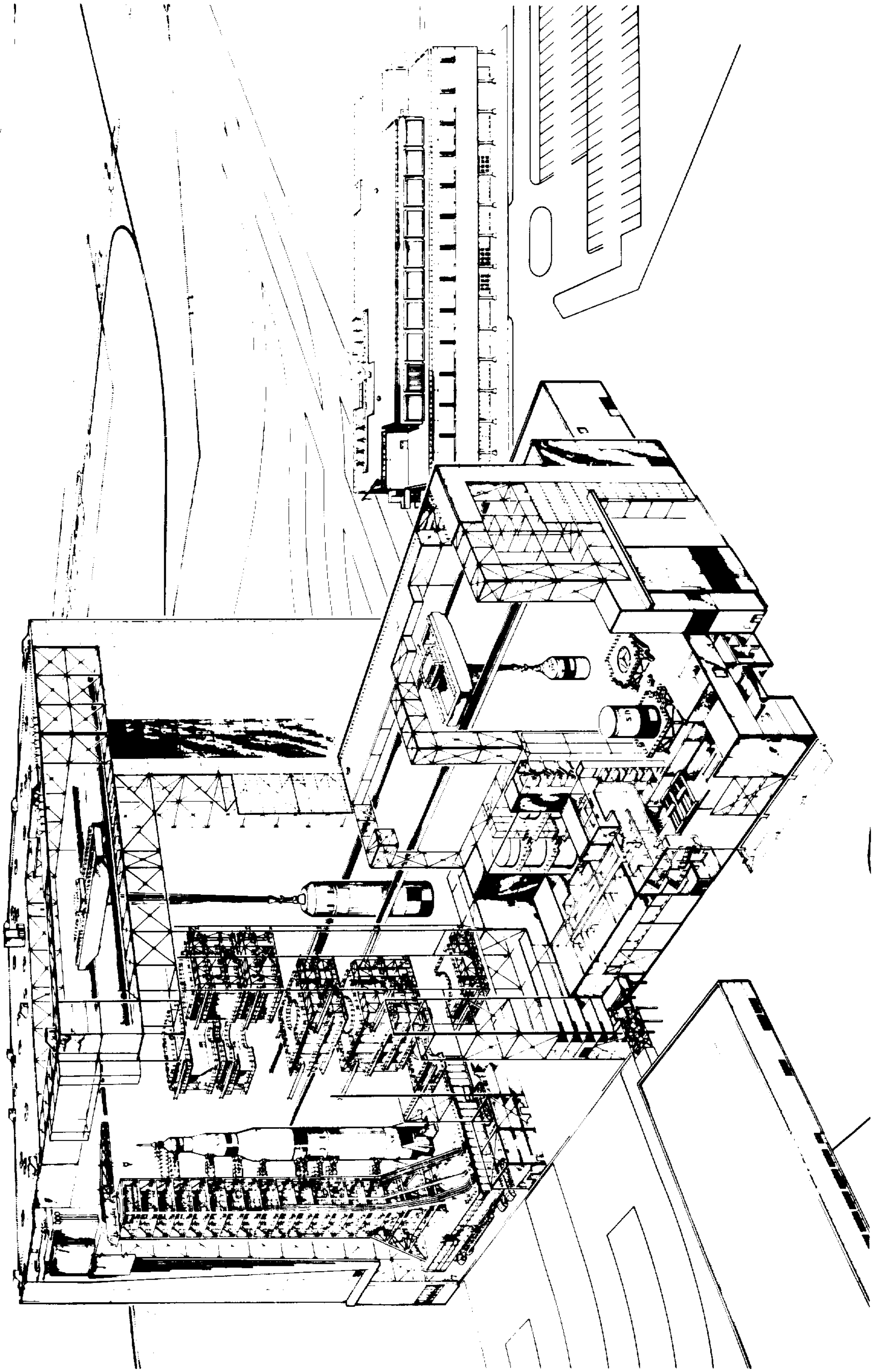


Figure 2-3. Vehicle Assembly Building (Phantom View)

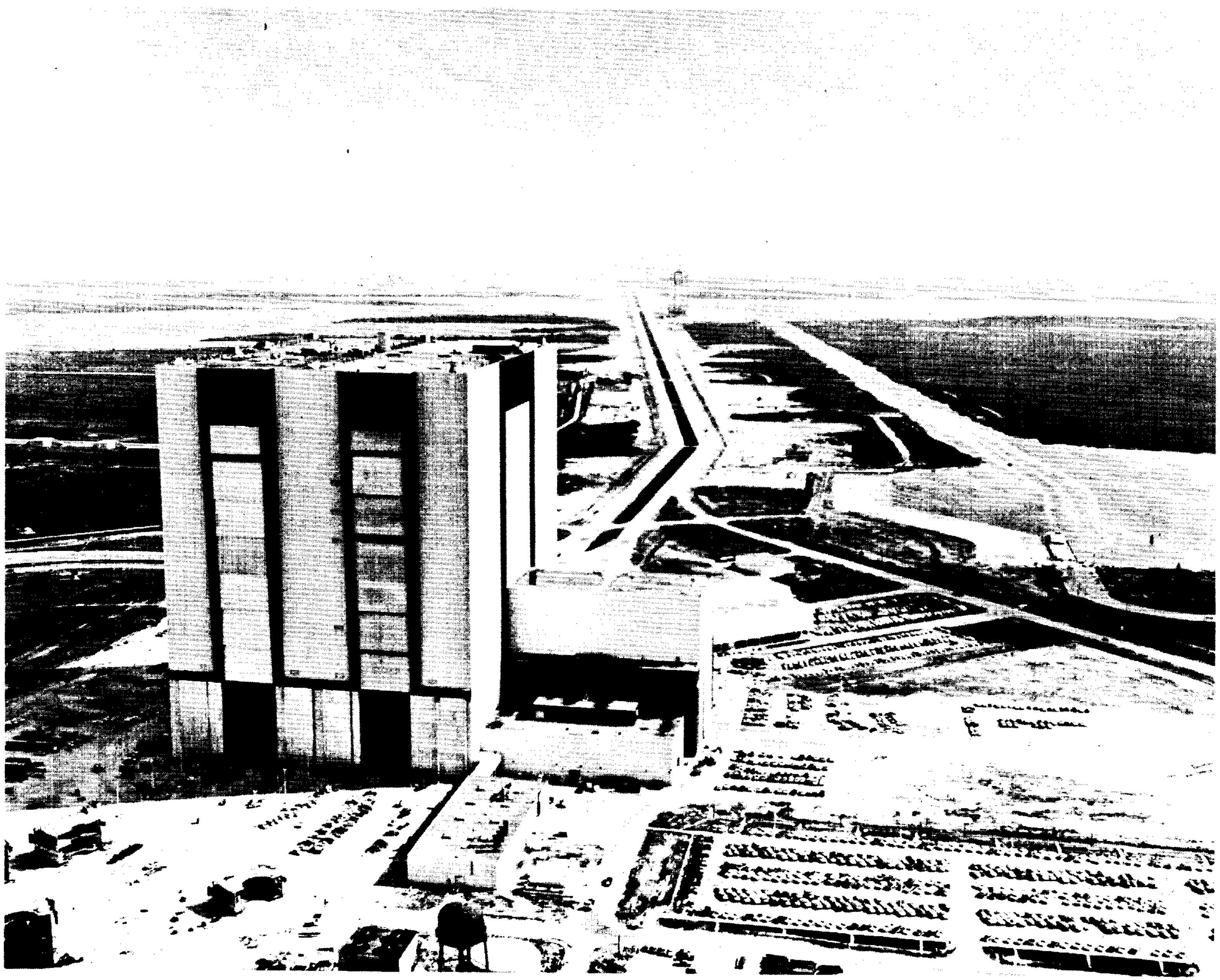


Figure 2-4. Vehicle Assembly Building

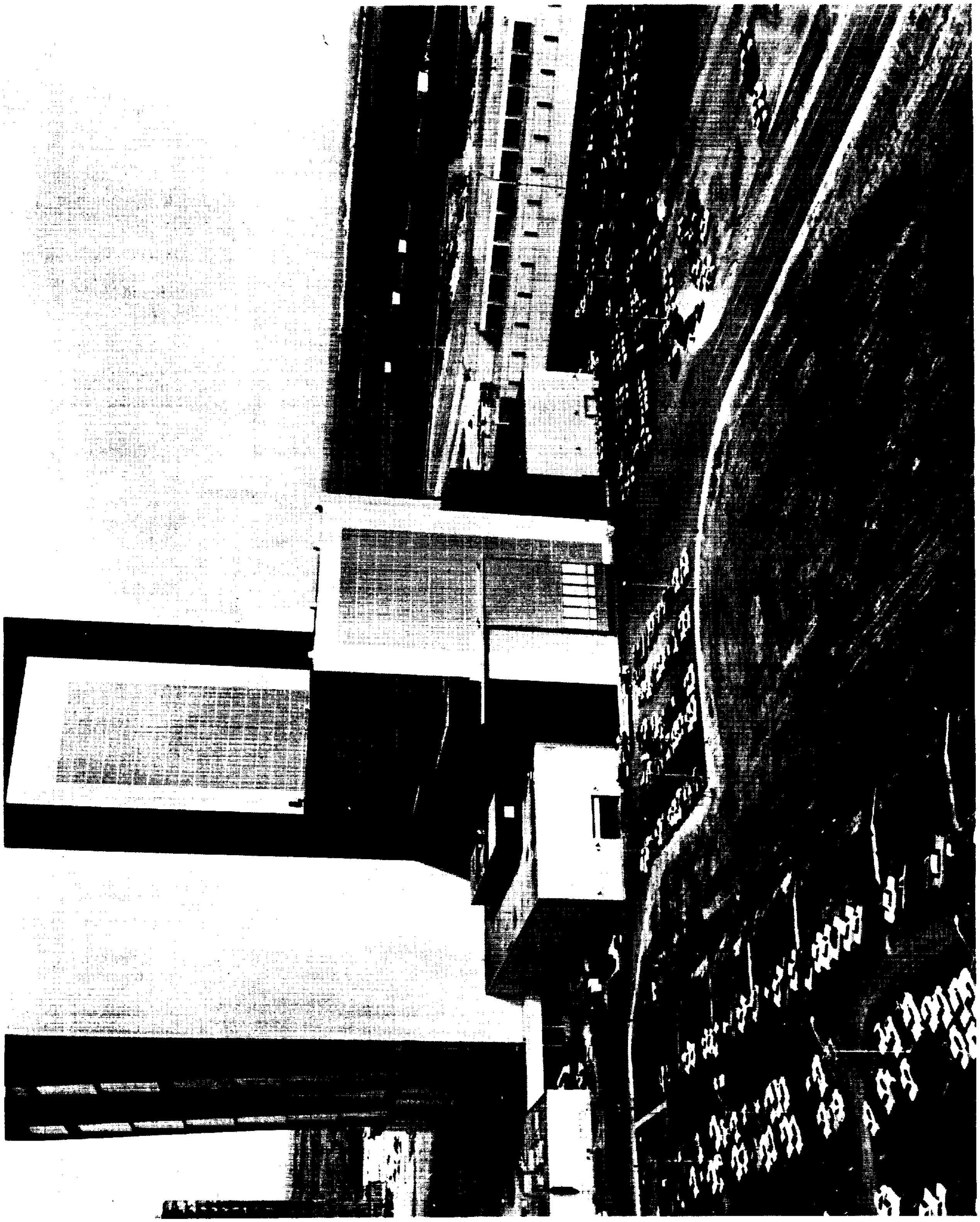


Figure 2-5. Vehicle Assembly Building (Low Bay Area)

45 percent $\pm$ 5 percent relative humidity (RH) and heated to 70 degrees $\pm$ 2 degrees in winter. A 175-ton bridge crane services the transfer aisle. The hook height of the crane is 166 feet above ground floor level. This crane is used to transfer the stage from the low bay area to the high bay area. The checkout areas are of conventional, multi-story construction.

2.2.4.1 Work Platforms. Work platforms, made up of fixed and folded sections, fit the various stages as required. The platforms are bolted to the low bay structure to permit vertical repositioning for changes in stage configuration. Access from fixed floor levels to the work platforms is provided by stairs.

2.2.4.2 Elevators. The VAB low bay area has four elevators with a 57-foot travel at 350 feet per minute. Provision is made for operation with or without attendant using local controls.

2.2.4.3 Transfer Aisle Doors. Transfer aisle doors are of the sliding type and motor driven. They are designed to operate in a wind velocity of 43 miles per hour steady-state and gusts up to 63 miles per hour. The doors provide an opening 55 feet wide and 96 feet high on the south end of the low bay area.

2.2.5 HIGH BAY AREA. The high bay area (Figures 2-6 and 2-7) provides the facilities for erection and checkout of the Saturn IC; mating and integrated checkout operations of the S-II and S-IVB, Instrument Unit, and spacecraft. The high bay area is located in the northern section of the VAB and is approximately 525 feet high, 518 feet wide and 442 feet long. It contains four checkout bays, each capable of accommodating a fully assembled, heavy-class space vehicle. Expansion to six bays is possible.

Access to the vehicle is provided from air-conditioned work platforms that extend from either side of the high bay area to completely surround the various levels of the vehicle. Each platform is composed of two bi-parting sections. The sections can be positioned in the vertical plane. The floor and roof of the section conforms to and surrounds half of the vehicle. The floor and roof are equipped with hollow seals to provide an environmental seal against the vehicle.

2.2.5.1 Cranes. Each pair of bays is served by a 250-ton bridge crane with a hook height of 462 feet. (A 175-ton overhead bridge crane will serve the transfer aisle between the high bay and low bay areas.) The wall framing (referred to as diaphragms) has openings through which the 250-ton bridge cranes may operate. The diaphragms are slotted above the 190-foot elevation to allow for the movement of components from the transfer aisle to their assembly position on the LUT. The bay areas are ventilated and have nitrogen and helium gas concentration detection systems. Fireproof stairways extend from ground level to the roof.

2.2.5.2 Elevators. Each high bay has four elevators to provide personnel access to the many levels of the high bay area. The VAB high bays are provided with a total of

Figure 2-6. Vehicle Assembly Building (High Bay Area, East Elevation)

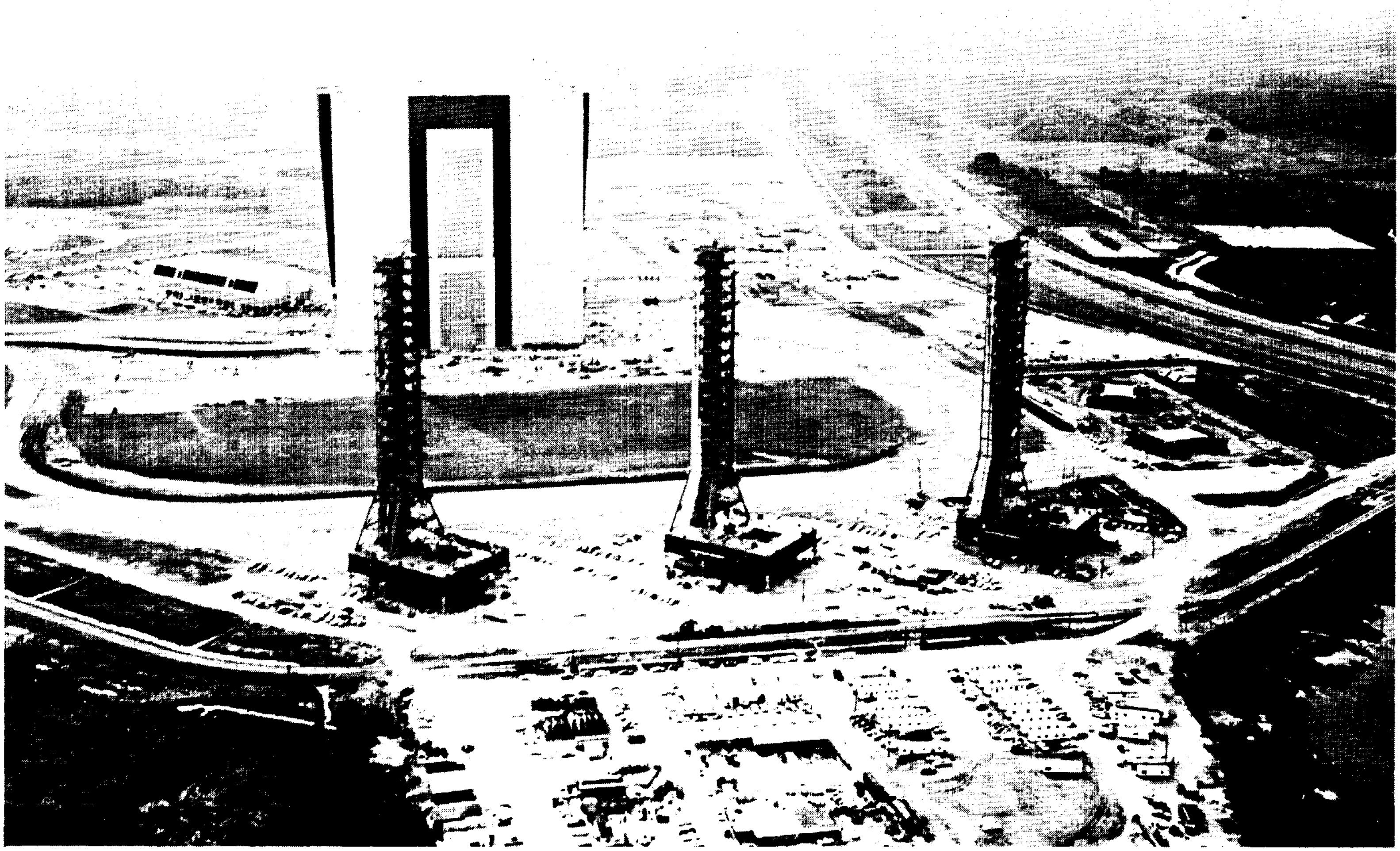


Figure 2-7. Vehicle Assembly Building (High Bay, North Elevation)

17 elevators. Sixteen elevators have a 419-foot travel at 700 feet per minute. Elevator No. 17 travels from floor 34 to the roof at 200 feet per minute. These are electric elevators with a full complement of manual and programmed automatic controls. They may be operated with or without attendant by use of local controls.

2.2.5.3 High Bay Doors. The high bay doors depict an inverted "T" with a clear opening of 456 feet in height. The bar of the "T" is 114 feet high and 152 feet wide. Above the bar of the "T", the opening is 72 feet wide and 342 feet high.

The bottom doors are four horizontally bi-parting panels on tracks, 114 feet high and 38 feet wide. Movement for each of the bottom doors is provided by a 7.5-horsepower electric motor. The upper doors comprise several leaves, 49 feet high, 76 feet wide, weighing 63,000 pounds each. Each door is moved vertically by a counter-weight system driven by a 7.5-horsepower electric motor. The high bay transfer aisle door is 55 feet wide and 57 feet high.

The high bay area assembly bays are heated by air-handling units, supplied heated water from the Utility Annex, or by independent heat pumps located on the platforms. In the winter, the temperature is maintained at 70 degrees $\pm$ 2 degrees FDB and 45 percent $\pm$ 2 degrees RH. The main open bay and corridors are ventilated at the rate of one air change per hour (ambient).

2.2.6 UTILITY ANNEX (K6-947). The Utility Annex (Figure 2-8) has the primary function of providing support to the VAB and LCC. It also provides support to other facilities in the VAB area. This facility is located in a separate structure on the west side of the VAB, adjacent to the low bay.

The building is approximately 103 feet wide and 253 feet long. A central refrigeration plant, consisting of centrifugal units driven by four 2,700 horsepower synchronous motors, provides 10,000 tons of air-conditioning with space for an additional 2,500-ton unit in the future. Four horizontal water tubes, forced circulation type hot water generators, provide 16,000 Btus per generator per hour. There is space for a future unit. Two air compressors provide 750 cubic feet per minute at 150 pounds per square inch. Three diesel-driven pumps provide 4,000 gallons of water per minute for fire protection. A 1,200-kw, diesel-driven generator provides emergency power.

2.2.7 HELIUM/NITROGEN STORAGE (K7-853) - VAB AREA. The gas storage facility at the VAB provides high-pressure gaseous helium and nitrogen for use with the launch vehicle stages, etc. It is located east of the VAB and south of the Crawlerway. The storage facility is a one-story reinforced concrete structure, approximately 83 feet by 98 feet. This structure has a reinforced concrete removable metal panel roof deck to afford installation and removal of pressure vessels through the roof. It includes the high-pressure storage battery, consisting of a 6,000 cubic foot (water volume) high-pressure storage for nitrogen, together with associated valve gages and filter. This facility is serviced by a 2.5-inch 6,000 psig gaseous nitrogen line and a 1.5-inch 6,000 psig gaseous helium line from the Converter/Compressor Facility (CCF).

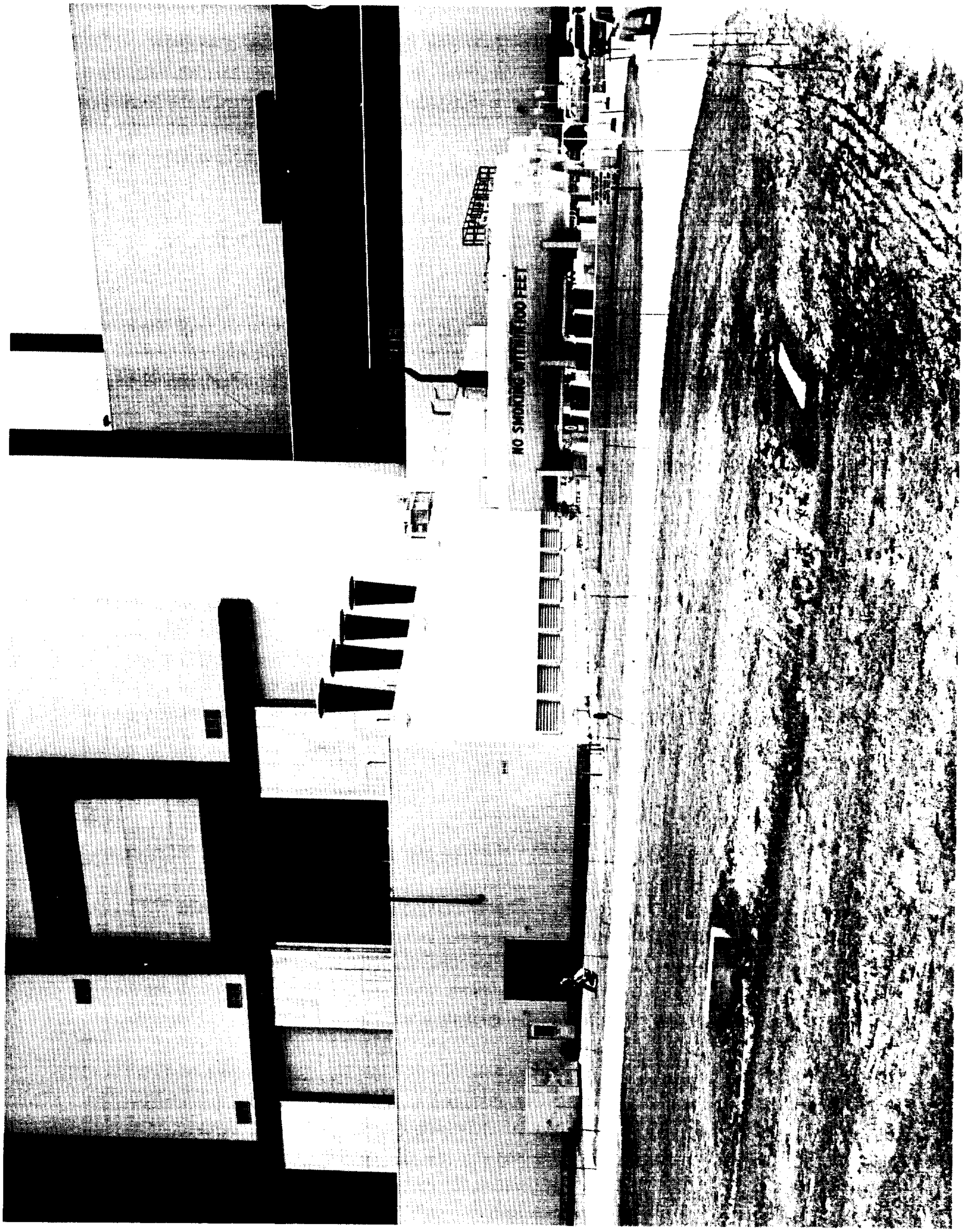


Figure 2-8. Utility Annex

2.3 LAUNCH PAD

2.3.1 FUNCTION. The launch pad (Figures 2-9 and 2-10) provides a stable foundation for the LUT during Apollo/Saturn V launch and prelaunch operations and an interface to the LUT for LUT and Apollo/Saturn V Systems. The pad structure provides space for Environmental Control Systems (ECS), fresh air intake, high-pressure gas storage, the Pad Terminal Connection Room (PTCR), portions of the Apollo Emergency Egress System, and the flame trench.

2.3.2 LOCATION. The pads are approximately 3.5 miles from the VAB area (Figures 2-1 and 2-9.).

2.3.3 PAD LAUNCH STRUCTURE. The launch pad is a cellular reinforced concrete structure (Figure 2-11). The top elevation of this structure is 48 feet above sea level (or 42 feet above grade elevation). The longitudinal axis of the pad is oriented N-S, the Crawlerway and ramp approach from the south.

Located within the fill under the west side of the structure (Figure 2-11) is a two-story concrete building to house environmental control and pad terminal connection equipment. On the east side of the structure, within the fill, is a one-story concrete building to house the high-pressure gas storage battery. On the pad surface are elevators, staircases, and interface structures to provide service to the LUT and the MSS. A ramp, with a five percent grade, provides access from the Crawlerway. This is used by the C/T to position the LUT/SV and the MSS on the support pedestals. The Azimuth Alignment Building is located on the approach ramp in the Crawlerway median strip. A flame trench (Figures 2-11 and 2-12), 58 feet wide by 450 feet long, bisects the pad. This trench opens to grade at the north end. The 700,000-pound mobile wedge-type flame deflector is mounted on rails in the trench.

An escape chute is provided to connect the LUT to an underground hard room. This room is located in the fill area west of the support structure. This is used by astronauts and service crews in the event of a malfunction during the final phase of the countdown.

2.3.3.1 <u>Pad Terminal Connection Room.</u> The PTCR provides the terminals for communication and data link transmission connections between the LUT or MSS and the launch area facilities and between the LUT or MSS and the LCC. This facility also accommodates the electronic equipment that simulates the vehicle and the LUT functions for checkout of the facilities during the absence of the LUT/SV.

The PTCR is a two-story hardened structure within the fill on the west side of the launch support structure. The launch pedestal and the deflector area are located immediately adjacent to this structure. Each of the floors of this structure measures approximately 136 feet by 56 feet. Entry is made from the west side of the launch support structure at ground level into the first floor area. Instrumentation cabling from the PTCR extends to the LUT, MSS, high-pressure gas storage battery area, LOX facility, RP-1 facility,

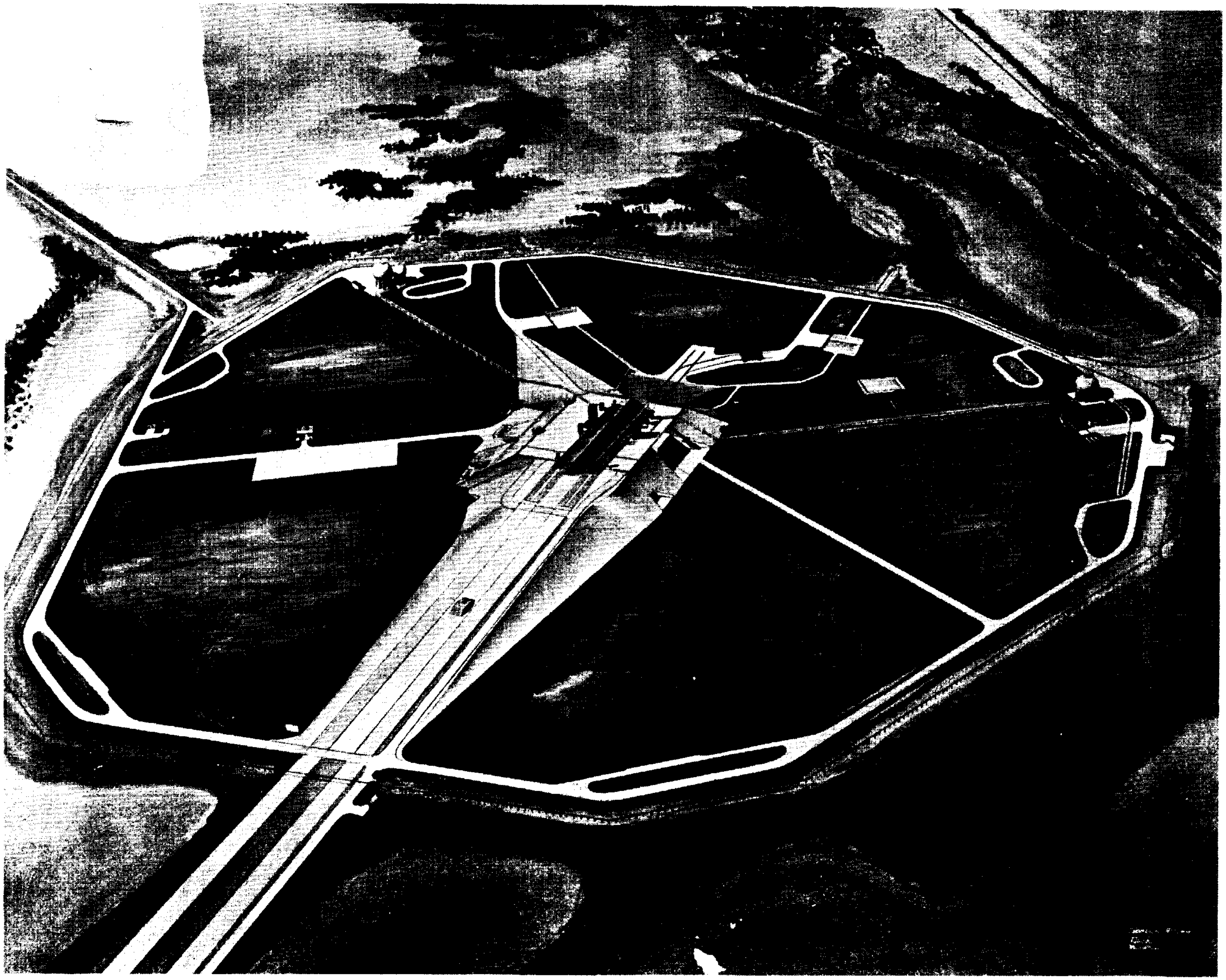


Figure 2-9. Launch Area A (Concept)

Figure 2-10. Launch Area A (Looking East)

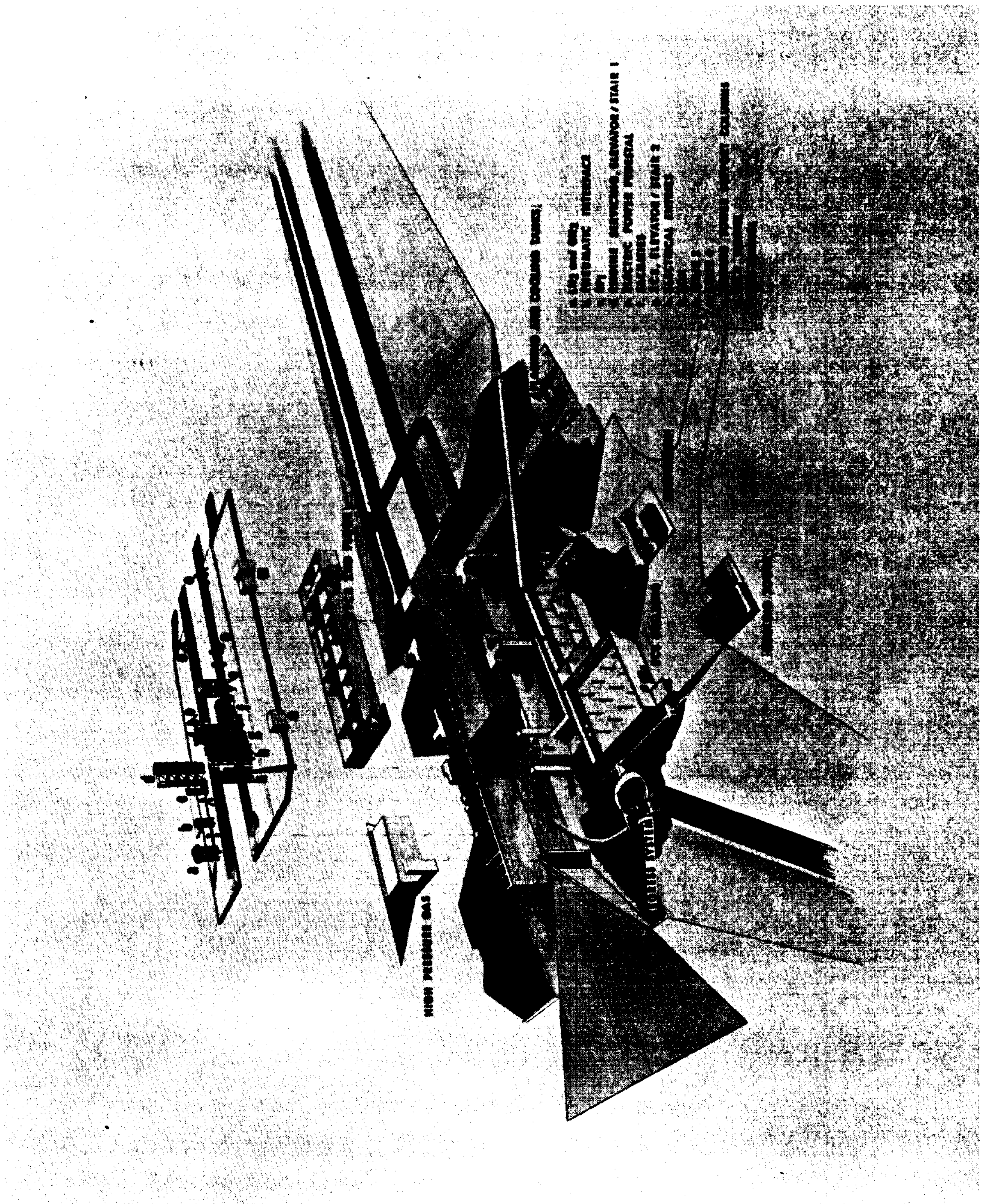


Figure 2-11. Launch Pad A (Exploded View)

LH_2 facility, and Azimuth Alignment Building. The equipment areas of this building are equipped with elevated false floors to accommodate the instrumentation and communication cables used for interconnecting instrumentation racks and terminal distributors.

An air-conditioned environment of 75 degrees $\pm$ 2 degrees FDB and 50 $\pm$ 5 percent RH is provided for equipment cooling. In addition, this system provides the LUT, when on the pad, with chilled water for the air-handling units located in the equipment compartments. The air-conditioning equipment is located on the PTCR ground floor. This facility is occupied by personnel during the early phase of prelaunch checkout activities. The air-conditioning system is controlled remotely from the LCC when personnel are evacuated for launch. A hydraulic elevator serves the two floors and the pad level.

Electrical power to this facility is "industrial" 277/480 v and "instrumentation" 120/208 v from a nearby substation. Illumination is provided by standard industrial fluorescent fixtures. Provisions have also been made in each equipment area for a grounding system which is isolated from all other grounds.

2.3.3.2 Environmental Control System Room. The ECS room houses the environmental control system equipment, which furnishes temperature and/or humidity controlled air or nitrogen for space vehicle cooling at the pad. It is located in the pad fill west of the support structure and north of the PTCR.

The ECS room is 96 feet wide by 112 feet long. The room houses air and nitrogen handling units, liquid chillers, air compressors, and auxiliary electrical and mechanical equipment consisting of the following:

a. Three 1050#/minute, 4-psig air compressors.

b. Two 60#/minute, 4-psig air compressors.

c. Three 250-ton liquid chillers.

d. One 3,000-gallon water/glycol storage tank.

e. Two 1050#/minute cooling coil units.

f. One 60#/minute cooling coil units.

g. Air reheat units.

h. Four 20-ton, self-contained, air-conditioning units for room and equipment cooling.

The ECS room environment is maintained at 80 degrees $\pm$ 2 degrees FDB and 60 percent $\pm$ 5 percent RH.

Figure 2-12. Launch Pad A (Looking South)

2.3.3.3 High-Pressure Gas System Facilities. The High-Pressure Gas Storage Facility (Figure 2-13) at the pad provides the launch vehicle with high-pressure helium and nitrogen for the purging, pressurization, propellant, and propulsion systems.

This facility is an integral part of the launch support structure located east of the pad. It is entered from ground elevation on the east side of the pad.

The high-pressure (6,000 psig) facilities at the pad include the high-pressure storage battery, consisting of 3,000 cubic foot water volume of high-pressure storage of gaseous nitrogen and 9,000 cubic foot water volume of high-pressure storage of helium.

2.3.3.4 Pad Interface Structure for Mobile Service Structure and Launch Umbilical Tower. The Pad Interface Structure (Figure 2-14) provides support pedestals, MSS and LUT support pedestals, support structures for fueling, pneumatic, electric power, environmental control, interfaces, and engine access platforms.

2.3.3.4.1 Support Pedestals. The MSS and the LUT are supported by four steel pedestals and six steel pedestals, respectively.

2.3.3.4.2 Interface Structures. The structures provide support for interface connections to the LUT (Figures 2-15 and 2-16) for:

a. LH_2.
b. GH_2.
c. High-pressure pneumatics.
d. RP-1.
e. Electrical power.
f. Facilities.
g. Environmental control.
h. Electrical communications, control and instrumentation.
i. LOX.

2.3.3.4.3 Engine Servicing Structures. This structure provides access to the LUT deck for servicing of the S-IC engine and LUT deck equipment.

2.3.3.5 Apollo Emergency Ingress/Egress and Escape System. The Apollo Emergency Ingress/Egress and Escape System provides access to and from the Command Module (CM) plus an escape route and safe quarters for the astronauts and service personnel in the event of a serious malfunction prior to launch.

The Apollo Emergency Ingress/Egress and Escape System consists of the Command Module Access Arm, a transition platform, two high speed elevators, pad elevator no. 2, armored vehicles, the escape tube, and the blast room.

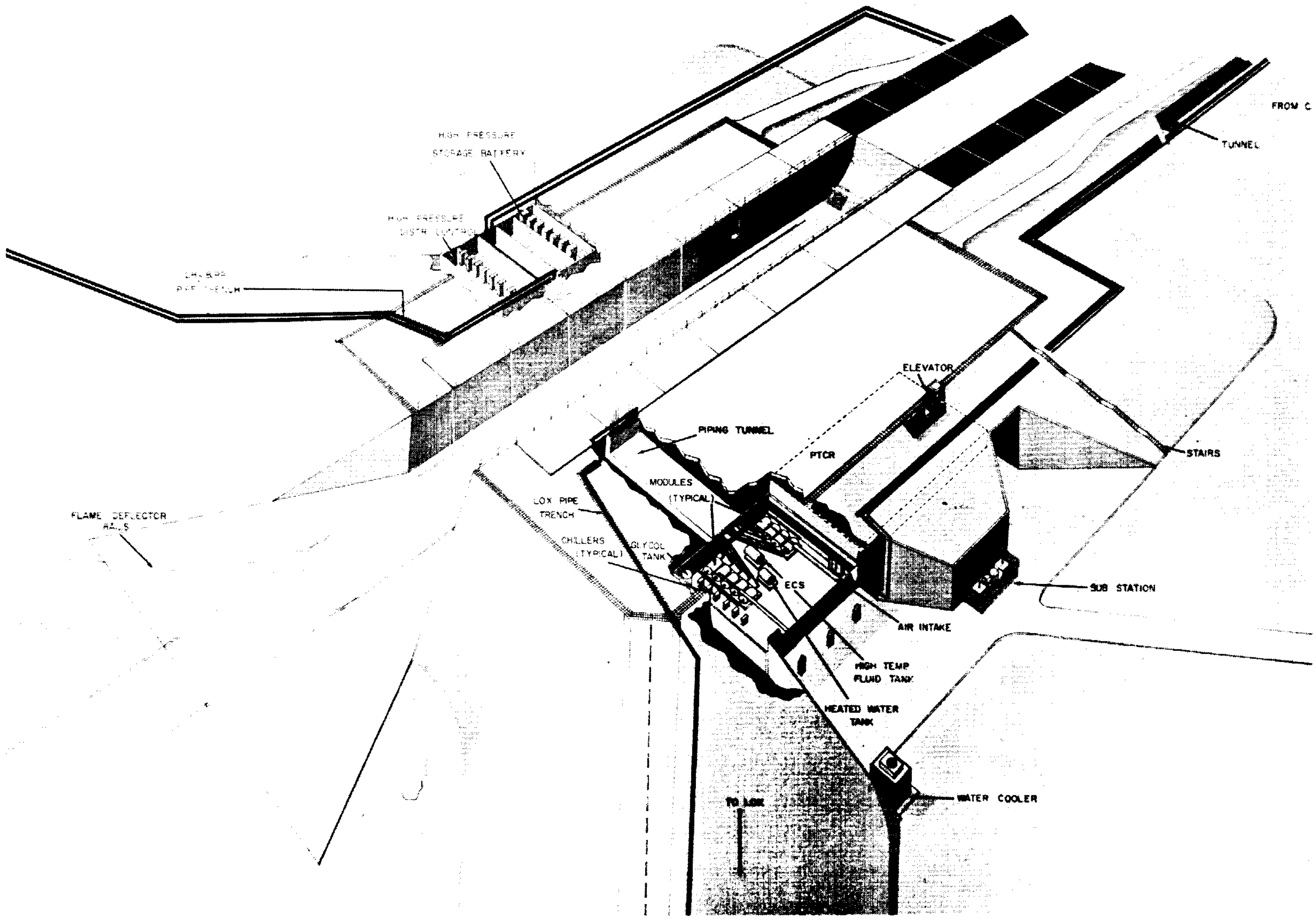


Figure 2-13. Launch Pad High-Pressure Gas Facility (Concept)

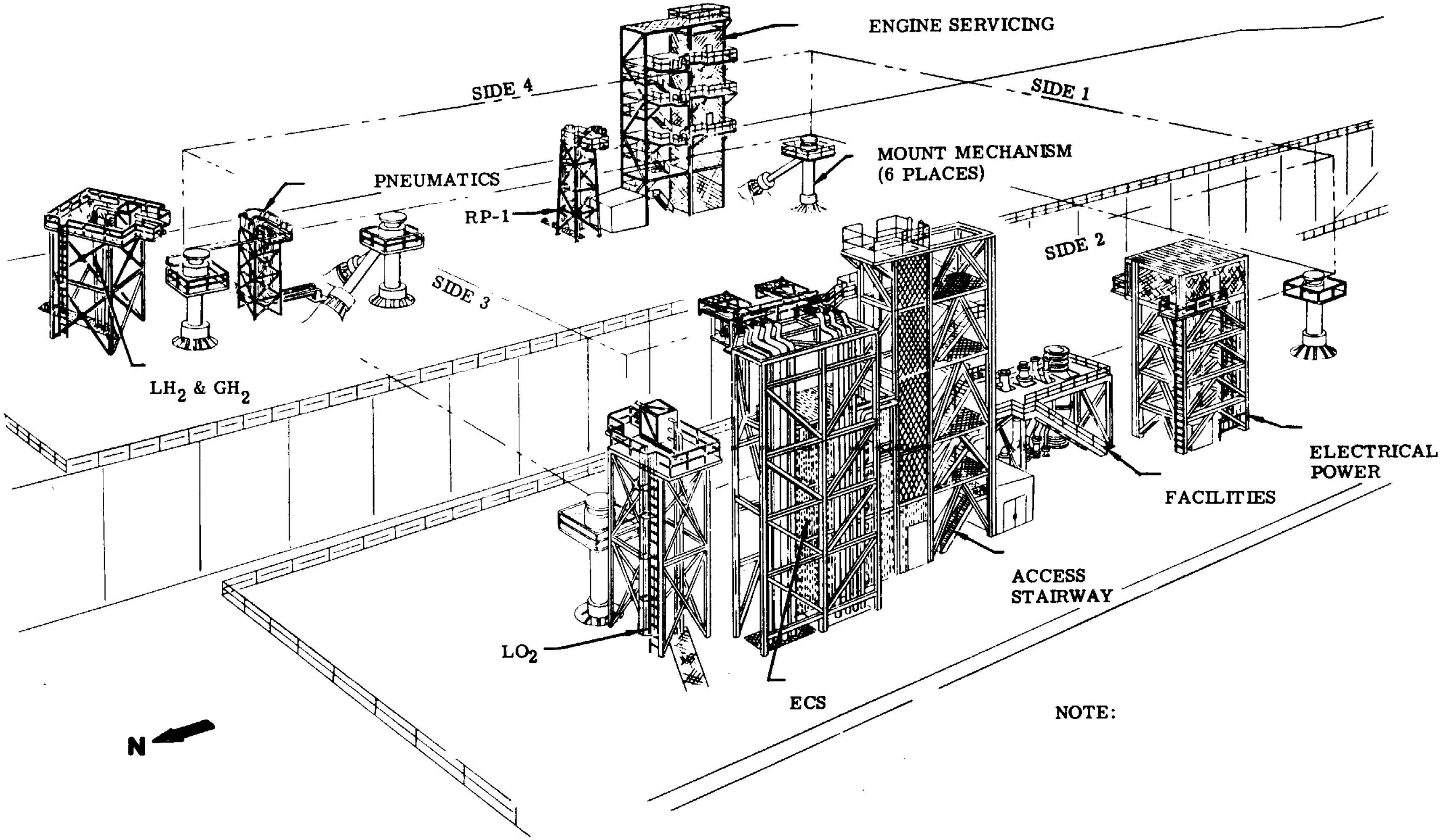


Figure 2-14. Launch Pad Interface System

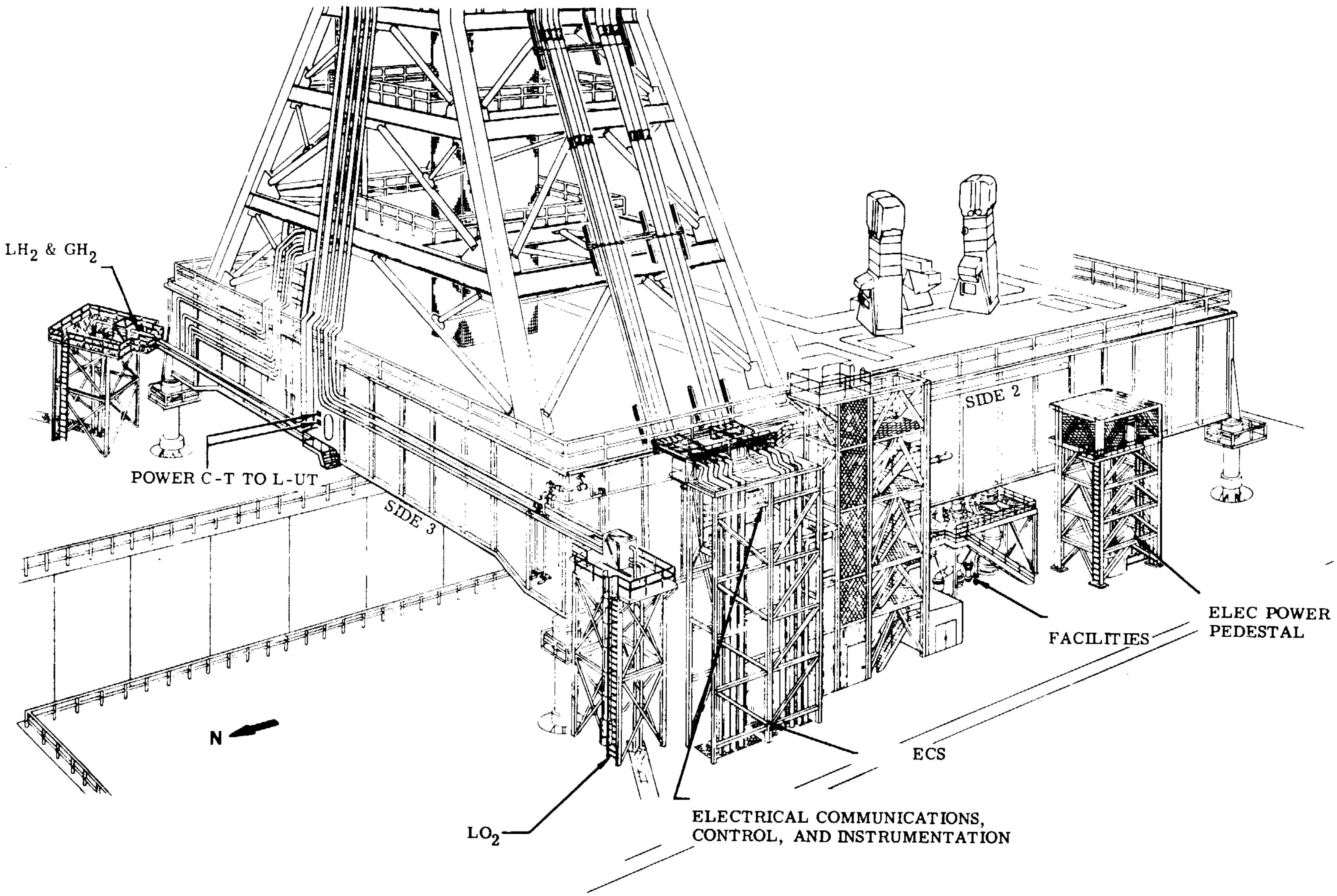


Figure 2-15. Launch Pad to LUT Interface Connections (Sides 2 and 3)

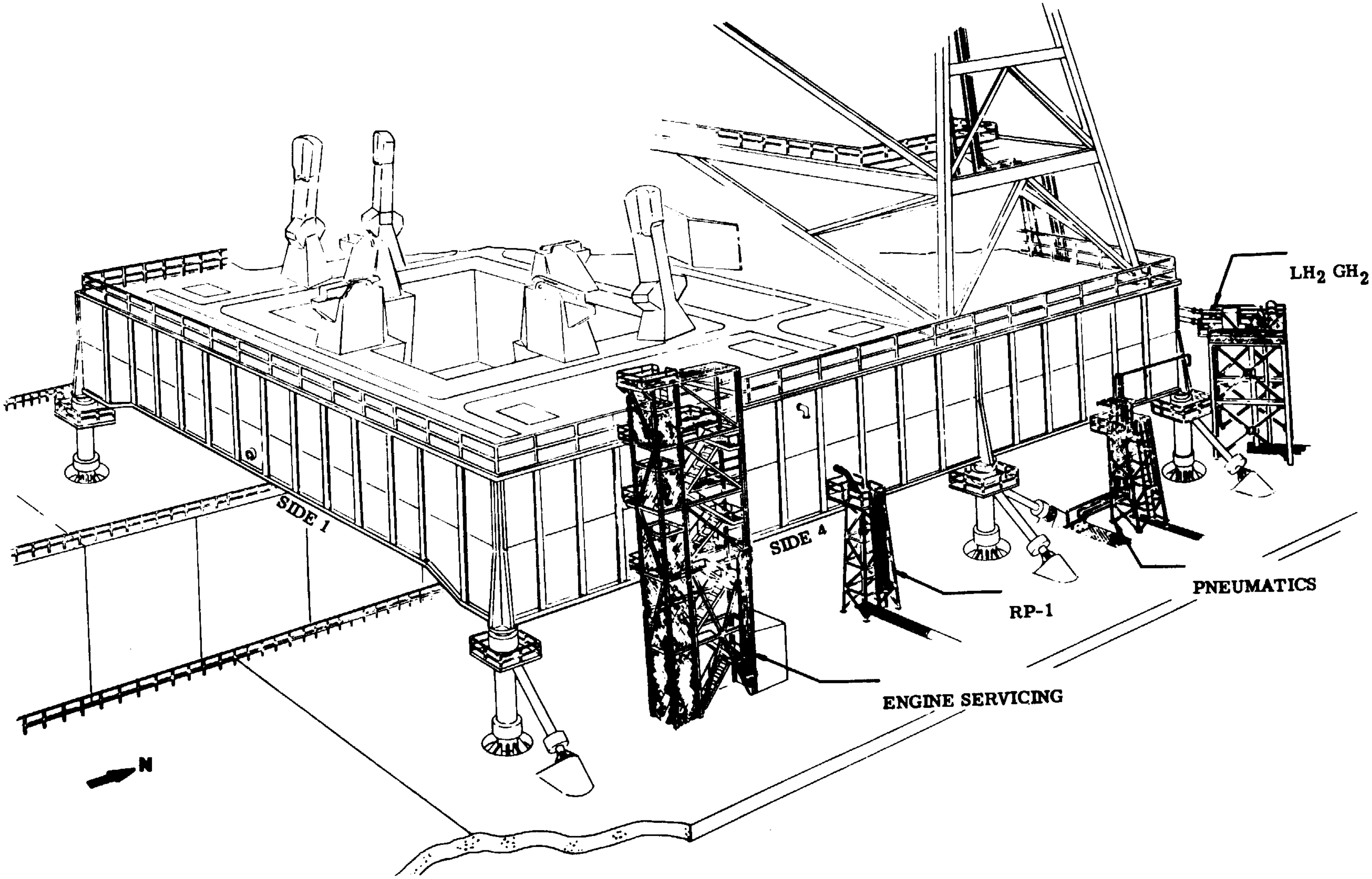


Figure 2-16. Launch Pad to LUT Interface Connections (Sides 1 and 4)

2.3.3.5.1 Command Module Access Arm. The Command Module Access Arm provides a passage for the astronauts and the service personnel to and from the spacecraft at the 320-foot level of the LUT. Once initiated, the action of the arm is automatic throughout the cycle and is controlled from the firing room.

2.3.3.5.2 High Speed Elevators. Two 600 feet per minute elevators permit travel from the 340-foot level of the LUT to level "A". Each elevator has 2,500 pound capacity. No remote controls are provided; however, continuous indication is displayed in the Complex Control Center, showing that the elevators are descending from the time they leave the 340-foot level until they reach level "A".

2.3.3.5.3 Escape Tube. The escape tube permits personnel, who have insufficient time due to the state of the emergency, to retreat from the area via pad elevator No. 2, to escape hazardous conditions by sliding down into the blast room vestibule. The tube consists of a short section which extends from the elevator vestibule and interfaces with a fixed portion that penetrates the pad at an elevation of 48 feet. At the lower extremity of the illuminated escape tube, a deceleration ramp is provided to reduce exit velocity, permitting safe exit for the user.

2.3.3.5.4 Blast Room. Entrance to the blast room is gained through the blast-proof doors which can be controlled from either side. The floor of the blast room is mounted on coil springs to reduce outside acceleration forces to 3 to 5 g's. Accommodations are provided for twenty people for a twenty-four hour stay. Provision is made to decrease the velocity of the air moving in the air ducts outside the blast room, thereby providing two escape routes through the ducts. Further retreat procedures will be specified at a later time by the Emergency Egress Committee. Communication facilities are provided in the room including an emergency RF link in which the receiving antenna is built into the ceiling. In the event that escape via the blast-proof doors is negated, a hatch is provided in the top of the blast room for access by rescue crews.

2.3.3.5.5 Pad Elevator. From the LUT elevator vestibule, egressing personnel will proceed along the corridor to pad elevator No. 2. The elevator must be left at level "A" to provide rapid access to the pad level.

2.3.3.5.6 Armored Vehicles. Armored vehicles and/or major personnel carriers will be available at the pad adjacent to pad elevator No. 2, at the remote air intake facility, and at the PTCR exit. Routing of the retreat is determined by the specific emergency and will be determined by the Emergency Egress Committee.

2.3.4 PAD SUPPORT AREA. The Pad Support Area (Figure 2-9) is the area around the pad structure in which all support facilities are located.

2.3.4.1 Fuel System Facility. The Fuel System Facility (Figures 2-17 through 2-22) stores RP-1 and LH_2, and is located within the launch pad area, on the pad side of the perimeter road. Each facility is approximately 1,450 feet from the center of the pad. The LH_2 and RP-1 facilities are in the northeast quadrant of the pad area. The two RP-1

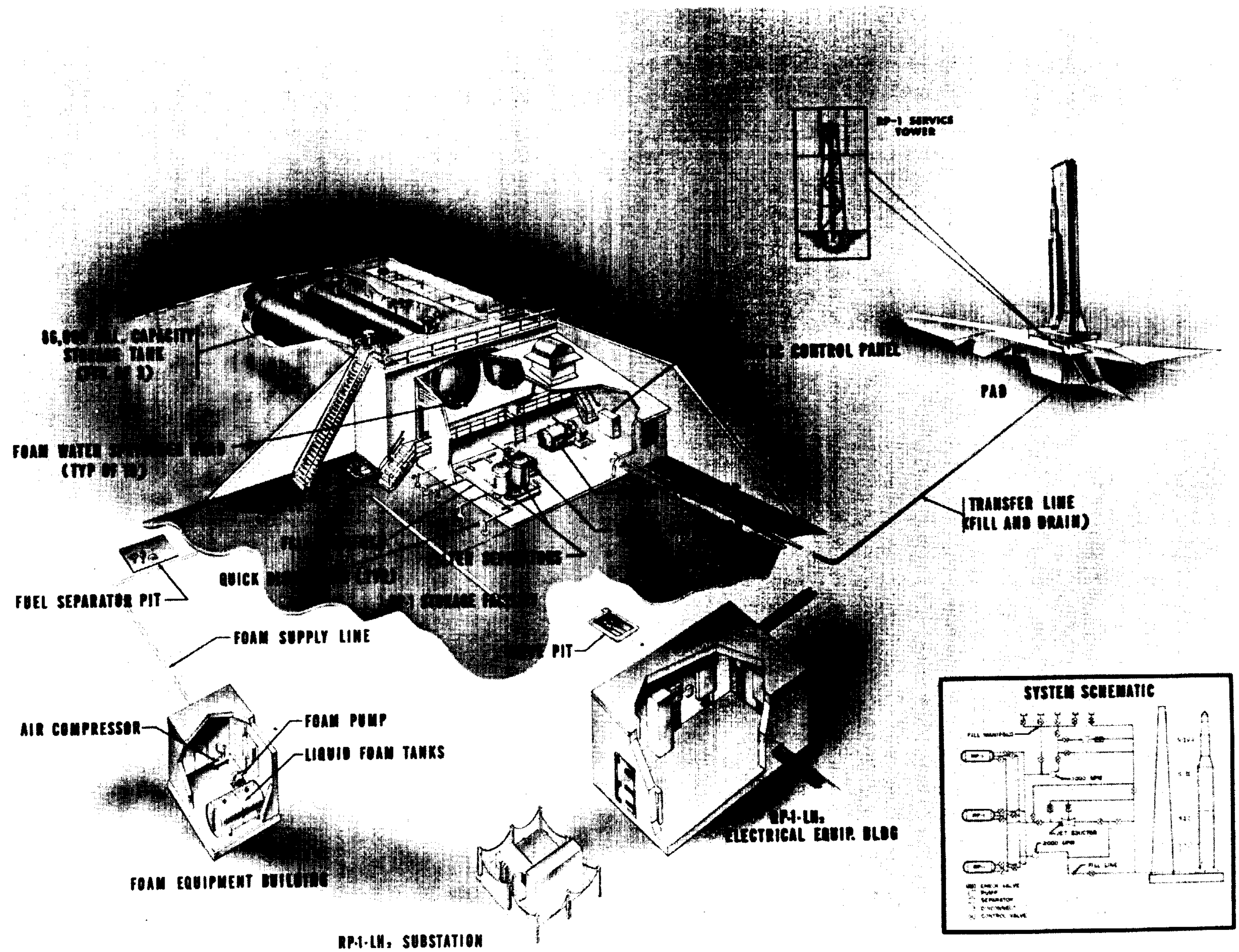


Figure 2-17. Launch Area A, RP-1 Storage Facility (Concept)

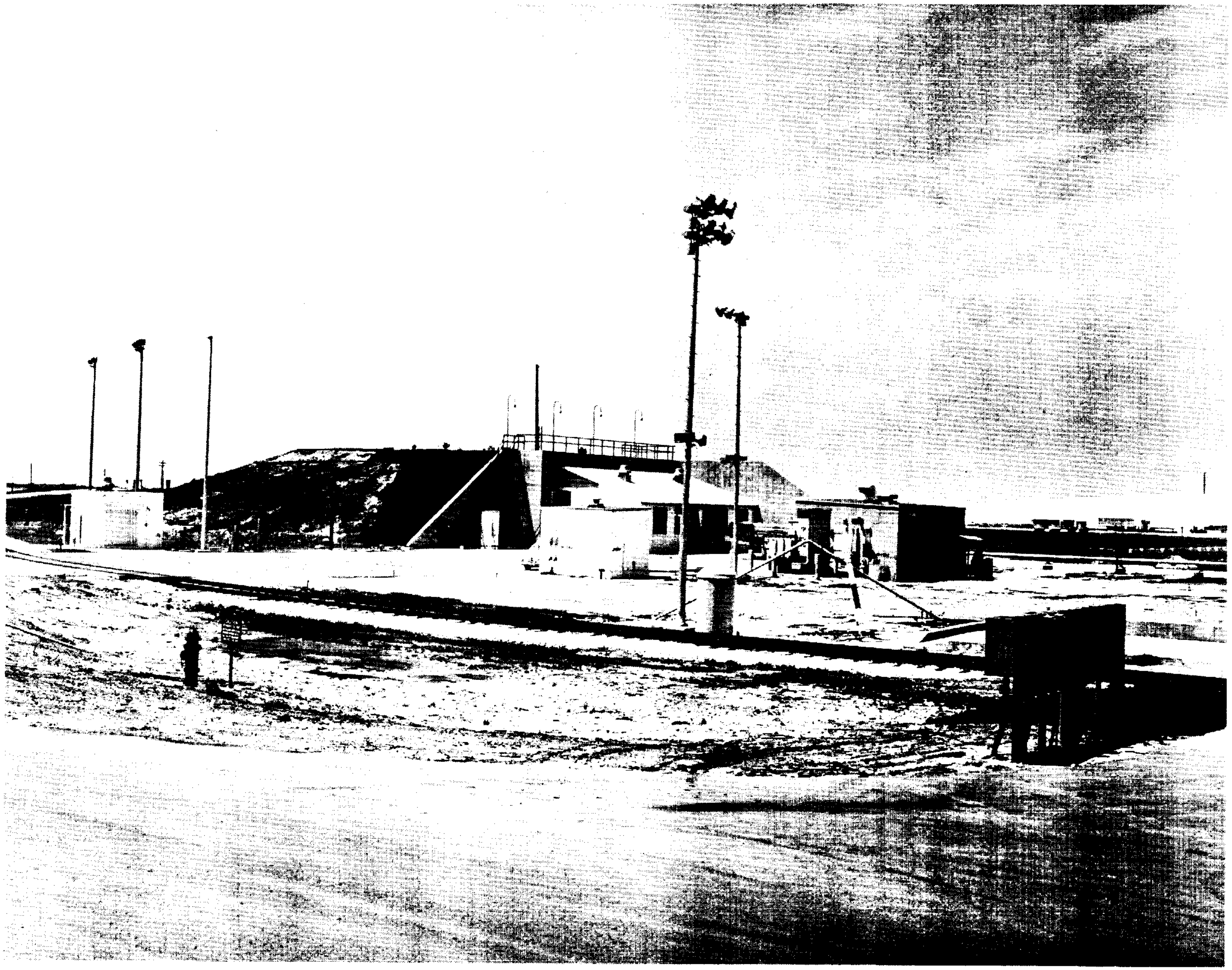


Figure 2-18. Launch Area A, RP-1 Storage Facility

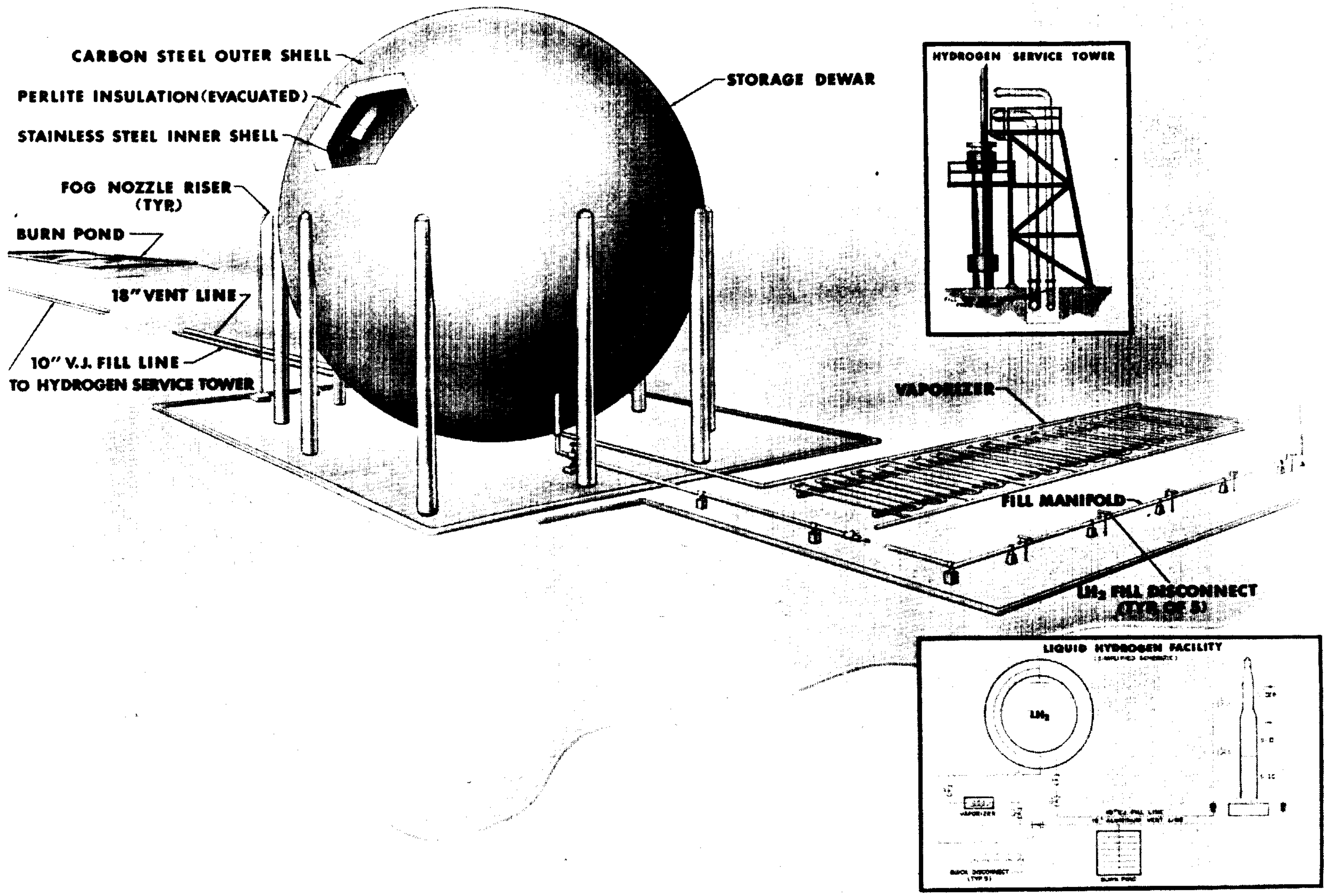


Figure 2-19. Launch Area A, LH_2 Storage Facility (Concept)

Figure 2-20. Launch Area A, LH_2 Storage Facility

Figure 2-21. Launch Area A, RP-1 Holding Pond

Figure 2-22. Launch Area A, GH_2 Burn Pond

holding ponds are north of the pad. One is east of the N-S pad axis and the other is west of the axis. The hydrogen burn pond is between the pad and the LH_2 facility.

2.3.4.1.1 RP-1 Facility Description (J8-1613). The RP-1 facility (Figures 2-17 and 2-18) consists of several 86,000 gallon storage tanks, a pump house 51 feet by 22 feet, a circulating pump, a transfer pump, filter separators, a cross-country line to the LUT interface, RP-1 foam generating building, 10 feet by 12 feet, and necessary valves, piping, and controls.

2.3.4.1.2 Holding Ponds Description. The holding ponds (Figure 2-21) are 150 feet by 250 feet with a water depth of two feet. A trap retains spilled RP-1 and discharges the water to drainage ditches.

2.3.4.1.3 LH_2 Facility Description (J8-1513). The LH_2 facility (Figures 2-19 and 2-20) consists of one 850,000 gallon (working capacity) storage tank, and LH_2 electrical building, 17 feet by 27 feet, tank vaporizer, and a cross-country line to the LUT interface.

2.3.4.1.4 Burn Pond Description. The burn pond (Figure 2-22) is 100 feet by 100 feet. A piping system with bubble caps provides a method for disposing vented hydrogen. A hot wire ignition system maintains the burning process. The water depth is two feet seven inches.

2.3.4.2 LOX System Facility (J8-1502). The LOX system facility stores LOX and is located within the launch pad area, on the pad side of Perimeter Road. The facility is approximately 1,450 feet from the center of the pad and is in the northwest quadrant of the area.

The LOX facility (Figure 2-23) consists of one 900,000 gallon (working capacity) storage tank, tank vaporizer, LOX electrical building 15 feet by 32 feet, main fill pumps, replenish pumps, and two transfer cross-country lines.

2.3.4.3 Gaseous Hydrogen Facility. This facility provides gaseous hydrogen for Saturn II and Saturn IVB turbine start and tank pressurization. It is located on the pad perimeter road, northwest of the liquid hydrogen facility. The gaseous hydrogen area consists of storage tanks having a capacity of 800 cubic feet, water volume, necessary valves and piping to charge the tanks, and a hard stand for a mobile recharger.

2.3.4.4 Azimuth Alignment Building (J8-1858). The Azimuth Alignment Building (Figure 2-24) houses the auto-collimator theodolite which senses, by a light source, the rotational output of the stable platform.

The Azimuth Alignment Building is located approximately 700 feet from the LUT positioning pedestals between the Crawlerway of the approach ramp to each launch pad.

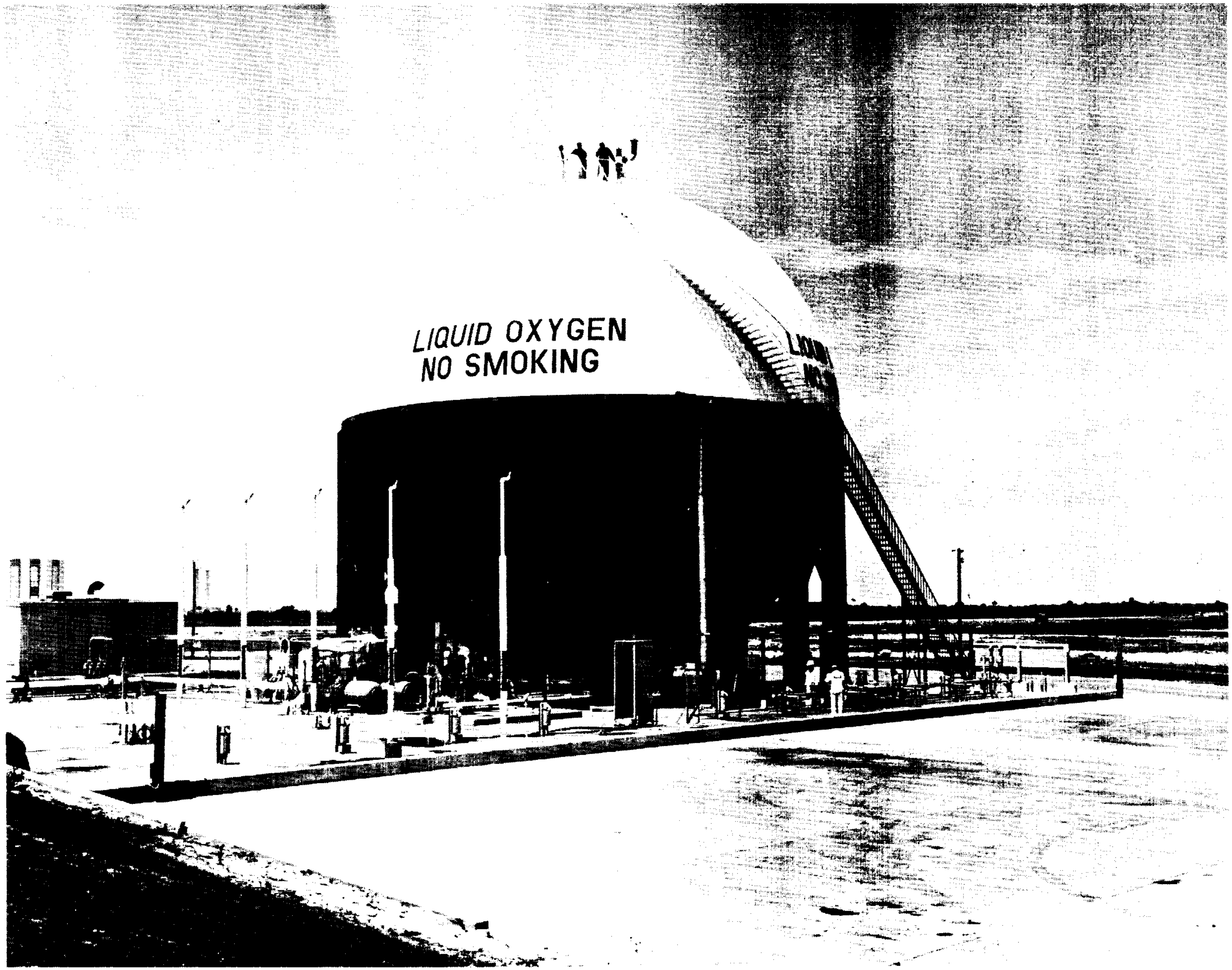


Figure 2-23. Launch Area A, LOX Storage Facility

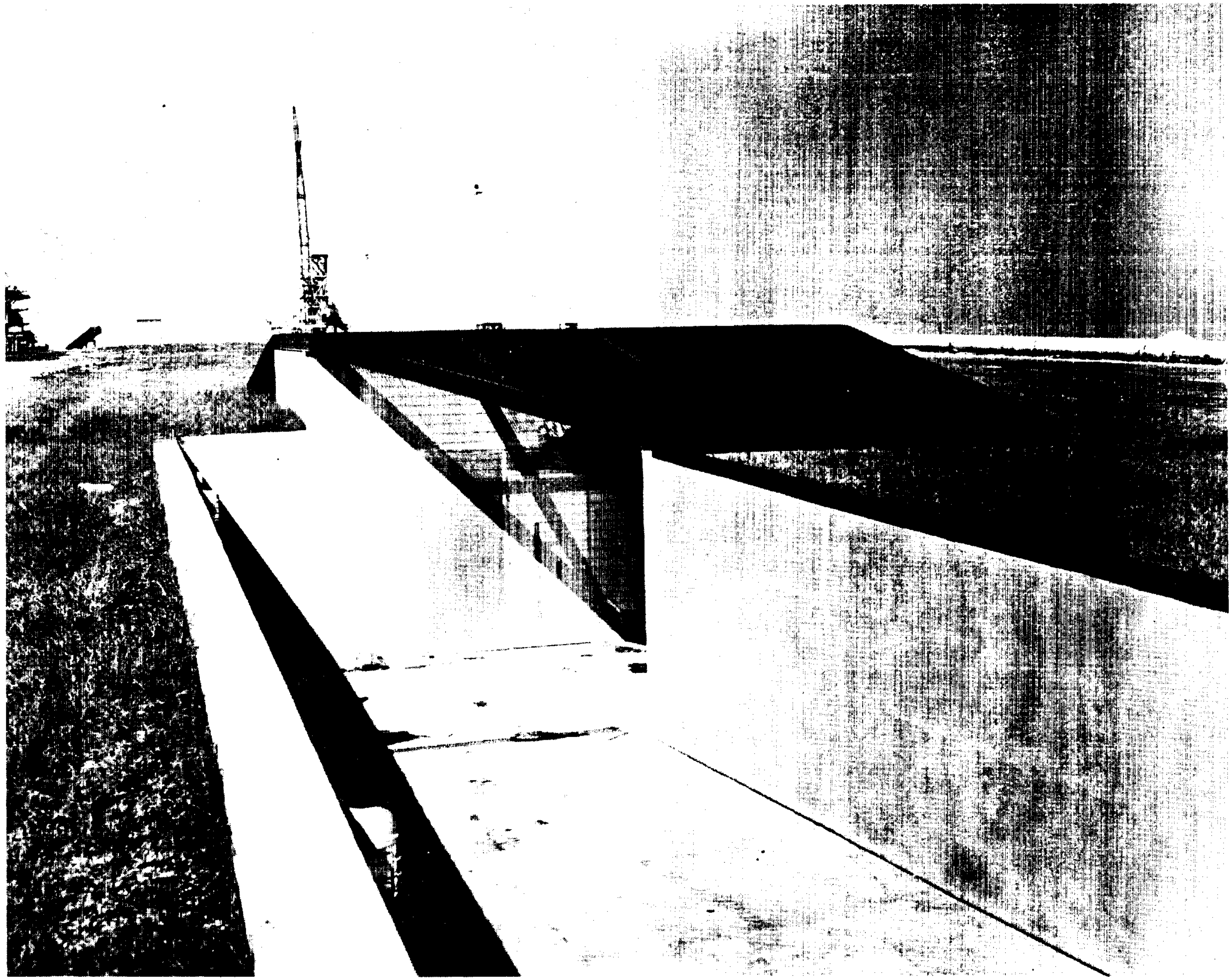


Figure 2-24. Launch Area A, Azimuth Alignment Building

This building is constructed of poured concrete with a minimum thickness of one foot for exposed portions. Entrance to this area is through a door at the end of a sloping ramp located on the side away from the vehicle. Usable area of the building is approximately 756 square feet.

A short pedestal with a spread footing isolated from the building is provided as a mounting surface for the theodolite instrument. The distance from the center line of the theodolite to the center line of the space vehicle is 765 feet, 7-1/6 inches. A theodolite elevation angle of 24 degrees provides line-of-sight to the stable platform.

Data from the auto-collimator theodolite is fed through the platform and the ESE Computer Complex for comparison with the desired coordinate system. Corrections to the preset coordinate are sent to the "Y" axis gyro of the stable platform to return the stable platform to the desired coordinate.

2.3.4.5 Photography Facilities. These facilities support photographic camera and Closed Circuit Television (CCTV) equipment to provide real-time viewing and photographic documentation coverage as required.

Camera site facilities are located around the launch support structure on the inside of the perimeter service road of the launch pad area.

There are six camera sites in the launch pad area (J8-1512, 1714, 1961, 1956, 1703, 1554). All six sites have an access road, five concrete camera pads, a target pole, communication boxes, and a power transformer with distribution panel and power boxes. These sites cover prelaunch activities and launch operations from six different angles at a radial distance of approximately 1,300 feet from the launch vehicle.

The five concrete pads at each six camera sites are for the following equipment: four engineering sequential cameras; and one Fixed High Speed Metric Camera (CZR). The four pads for the engineering sequential cameras are six feet wide by 16 feet long and slightly above existing site grade elevation. These pads are in line and are sited with the long dimension aligned on tangent lines to the line-of-sight to the launch vehicle. Elevation of these pads and the site is approximately 18 feet above sea level; that is 10 feet above the perimeter road. The CZR camera pad is 6 feet wide by 10 feet long and is 25 feet from the nearest engineering sequential camera pad. This pad is aligned the same as the four engineering sequential camera pads. A CZR truck parking area is provided adjacent to the CZR pad.

A target pole for optical alignment of the CZR camera is located approximately 225 feet $\pm$ 25 feet from the CZR camera pad and is approximately 86 feet high.

2.3.4.6 Pad Water System Facilities. The pad water system facilities (Figures 2-25 through 2-27) furnish water to the launch pad for fire protection, cooling and quenching. The facilities are made up of Pad Pumping Station, Industrial Water System, and Firex System.

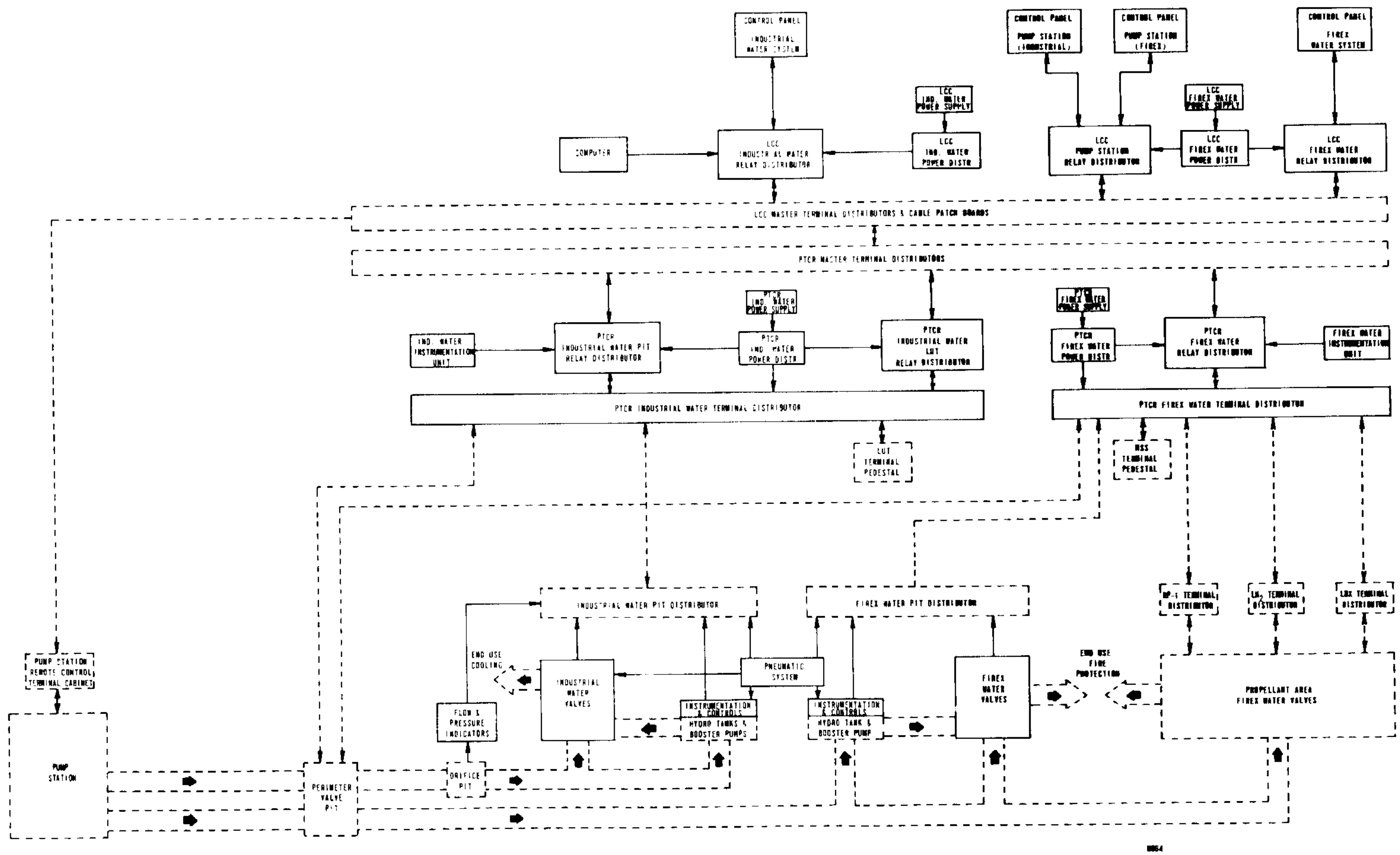


Figure 2-25. Launch Complex 39 Water System (Block Diagram)

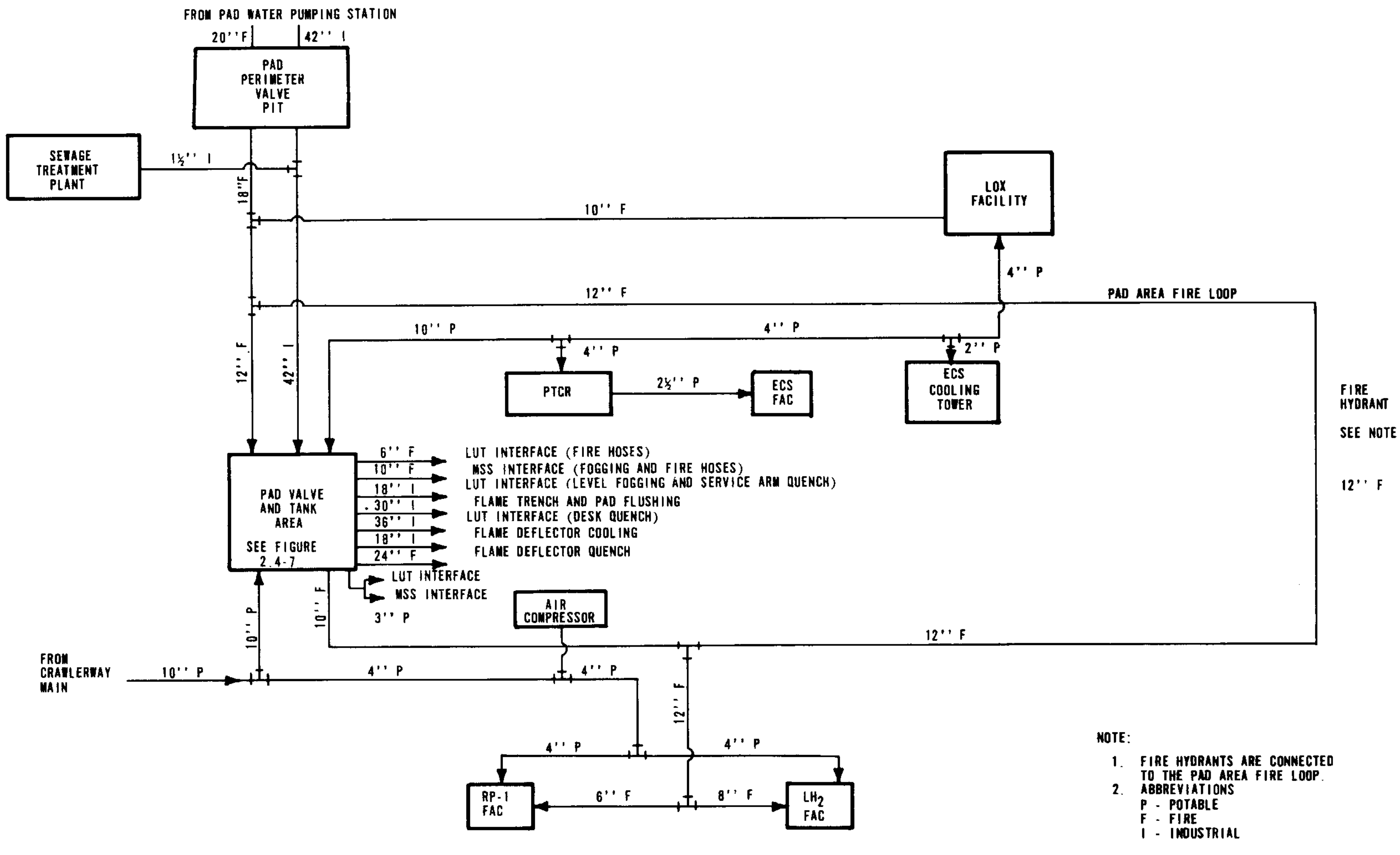


Figure 2-26. Launch Area Pumping Station (Block Diagram)

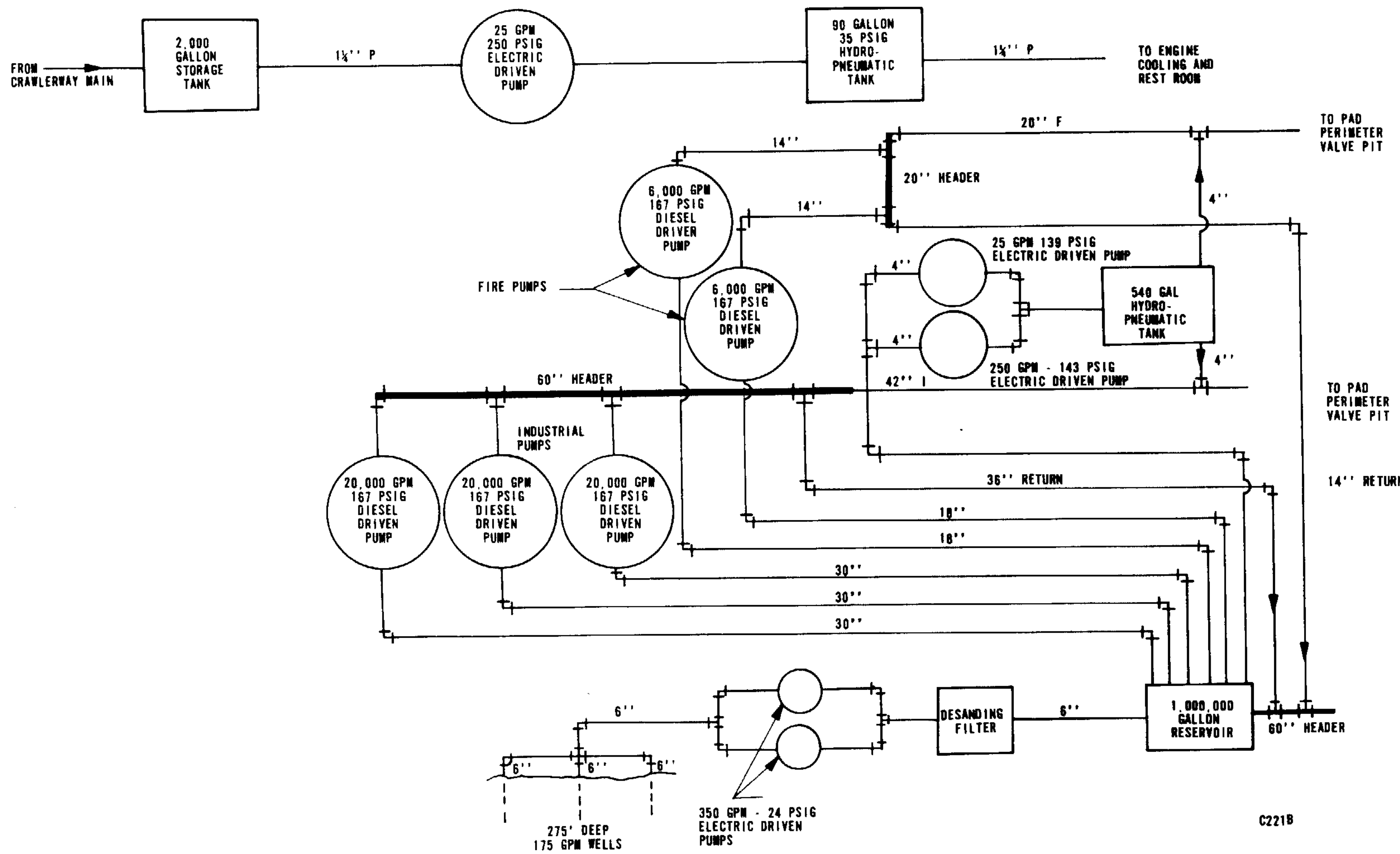


Figure 2-27. Launch Area Water Distribution (Block Diagram)

2.3.4.6.1 Pad Pumping Station. The water is supplied from three 6-inch wells, each 275 feet deep with a free flow of 175 gpm. The wells feed into a common header. The header supplies the inlets of two electric-driven pumps with a capacity of 350 gpm at 24 psig. The outlets from these well booster pumps feed a 1,000,000 gallon reservoir. The pumps are automatically controlled from level sensors in the reservoir. The water from the well booster pumps passes through a 350 gpm desanding filter.

There are three diesel engine-driven industrial water pumps, two diesel engine-driven fire water pumps, and two electrically driven jockey pumps in the station.

The industrial pumps are each directly connected to the ground reservoir by a 30-inch main. The industrial pumps have a capacity of 20,000 gpm, each with a discharge pressure of 167 psi. They feed into a 60-inch header.

The fire pumps are each directly connected to the ground reservoir by an 18-inch main. The fire pumps have a capacity of 6,000 gpm with a discharge pressure of 167 psi. They feed into a 20-inch header.

There is a 25-gpm, 139-psi jockey pump and a 250-gpm, 143-psi jockey pump. These pumps feed a 540-gallon hydropneumatic tank. This tank feeds both the industrial system and the fire system and maintains normal operating pressure in the systems.

The 60-inch industrial header feeds a 42-inch line and the 20-inch fire header feeds a 20-inch line. The 20-inch fire line reduces to an 18-inch line. Both lines are routed through the perimeter valve pit at the pad area. The valves in this pit are controlled from switches in the PTCR.

2.3.4.6.2 Industrial Water System. The industrial water system is supplied water from the pad pumping station through a 42-inch main routed through the pad perimeter valve pit to the pad valve and tank pit. The 42-inch main acts as a header which supplies water to the subsystems.

2.3.4.6.3 Flame Trench and Pad Flushing. This subsystem furnishes water to flush the flame trench and pad in the event of a propellant spill. The subsystem is supplied water through a 30-inch line from the header. The main furnishes water to the flame trench flushing nozzles at a rate of 8,000 gpm, and to the pad flushing nozzles at a rate of 14,000 gpm. The main has a capacity of 22,000 gpm. The flow is controlled from the PTCR or from the LCC.

2.3.4.6.4 Flame Deflector Cooling and Quench. The cooling subsystem is furnished water through an 18-inch line from the header. This line has a capacity of 8,000 gpm. The flow is controlled automatically from the terminal countdown sequencer. It starts flowing at T-10 seconds and stops at T+5 minutes.

The quench subsystem is supplied water from a 14,000 gallon storage tank in the valve pit through the 18-inch cooling line. The tank is filled through a 4-inch line from the 10-inch fire main in the pit. The tank is pressurized to 150 psig by gaseous nitrogen.

The tank discharges water through a 24-inch line to the flame deflector quench nozzles at a rate of 20,000 gpm. The flow is controlled automatically by the terminal countdown sequencer. Flow starts at T+2 seconds and terminates approximately 30 seconds later.

2.3.4.6.5 Launch Umbilical Tower Deck Cooling and Quench. This subsystem is furnished water through a 36-inch line from the header through the LUT interface. In addition, water is furnished from a 30,000-gallon tank. The discharge from this tank is connected to the 36-inch supply line. Check valves control back flow into the header or the tank. The tank is pressurized to 150 psig by gaseous nitrogen and is supplied water from the 10-inch fire line through a 6-inch line.

The flow to the deck nozzles is controlled by one valve operated by the terminal countdown sequencer. The valve opens at T+2 seconds and closes at T+5 minutes. A flow of 50,000 gpm discharges the tank in approximately 30 seconds. At this time, a flow of 20,000 gpm is supplied from the 42-inch header.

A quick-disconnect coupling connects the 36-inch main to the LUT at the LUT/pad interface. The water is piped to 44 quench nozzles or perforated pipes.

2.3.4.6.6 LUT Level Fogging and Service Arm Quench. This subsystem is furnished water through a 16-inch line from the header. The water passes through an electrically driven pump with a capacity of 7,500 gpm at 300 psig. The line is connected to the LUT by a quick-disconnect coupling at the LUT/pad interface.

Level fogging is provided at levels 30 feet, 120 feet, 160 feet and 200 feet. This consists of fogging nozzles located at each of the four corners of the tower. The water is supplied from the service arm quench riser. This flow is controlled by remote switches at the LCC.

2.3.4.6.7 Sewage Treatment Plant. Water is furnished to the plant through a 1.5-inch connection from the 42-inch industrial main.

2.3.4.6.8 Firex Water System. The fire water loop (Figure 2-26) is furnished water through an 18-inch line from the pad water pumping station, routed through the pad perimeter valve pit.

2.3.4.6.9 LOX Facility. The LOX facility is furnished water through a 10-inch connection to the 18-inch fire main. The fire protection consists of spray heads covering the tank and the fill ports. There are temperature sensors to show heat rise. The flow is controlled manually by remote switches located in the LCC.

2.3.4.6.10 LH_2 Facility. The water for this facility is furnished through a 12-inch connection to the 12-inch fire loop. This connection serves the fire hydrants in the LH_2 area and the RP-1 area. An 8-inch connection to the 12-inch line furnishes water to the storage tank and fill port spray heads. Temperature sensors show heat rise. The system is manually controlled by remote switches located in the LCC.

2.3.4.6.11 RP-1 Facility. A 6-inch connection to the 12-inch line serving the LH_2 facility serves the RP-1 fill port spray heads. A 4-inch connection furnishes water to the foam system. The RP-1 pump and the storage tank are covered by foam spray heads.

All fire hydrants in the pad area are served by the pad fire loop.

2.3.4.6.12 LUT Fire Water. A 6-inch connection to the 10-inch fire line serves the LUT fire hoses through the LUT interface. The fire water is supplied to the LUT through interfaces at the LUT erection area, VAB, and the launch pad. Fire hoses are located on level "0".

2.3.4.6.13 Mobile Service Structure. In the pad valve and tank pit, the 12-inch fire line is reduced to a 10-inch line. A 10-inch connection to the 12-inch fire line serves a 2,600-gpm, 300-psig pump. This pump serves the MSS interface. A 2.5-inch connection serves a 50-gpm, 300-psig pump which maintains water level in a 4,200-gallon hydropneumatic tank. This tank furnishes water during the interval needed for the booster pump to develop full pressure. The pressure in the tank is obtained by using gaseous nitrogen. An 8-inch line runs up the structure to a point above platform 4c.

The MSS fire system consists of fire hose racks located on deck level, levels 44, 133, 221 and platforms 3, 4a, and 4c; and fog nozzles located on platforms 3, 4a, and 4c. The fog nozzles are controlled by remote switches located in the LCC.

2.3.4.7 Air Intake Building. This building houses fans and filters for the air supply to the PTCR, pad cellular structure, and the LUT. This building is located west of the pad, between the pad and the perimeter road.

The building is 20 feet by 26 feet and contains three fans supplying 10,735 cfm to the PTCR, 25,550 cfm to the LUT, and 3,110 cfm to the pad cellular structure.

2.3.4.8 Sewage Treatment Plant (J8-1705). This plant is located at the pad area and provides primary treatment with a sludge gas burner. Plant design capacity is for 250 persons.

2.3.4.9 Operations Support Buildings. The Operations Support Buildings, two single-story structures, 30 by 30 feet and 35 by 35 feet, serve as workshops for the LOX and the LOX and the RP-1/LH_2 propellant facilities at the launch pad. The buildings are windowless concrete block structures with an exterior personnel door and one 10-foot by 10-foot roll-up metal door. Interior partitions are of dry wall construction. Each building will contain toilet-locker room facilities, heating and air-conditioning equipment, air compressor, and monorail hoist. An air compressor and tank can provide 20 scfm of air at 125 psi. A 6,000 pound capacity trolley mounted monorail hoist is installed in each facility on the centerline of the roll-up door. The minimum clear hook height of the hoists is 10 feet.

The 30 by 30 feet structure is located on the pad perimeter road west of the launch area, approximately 200 feet north of the LOX propellant facility. The other building is located on pad perimeter road east of the RP-1 site and southeast of the LH_2 site.

2.4 BARGE TERMINAL (K7-1005)

2.4.1 FUNCTION. The barge terminal (Figure 2-28) provides docking, unloading, and parking space for small ocean-going vessels and inland vessels delivering vehicle stages (S-IC and S-II) and bulky materials to LC-39.

2.4.2 LOCATION. The facility is located in the VAB area south of the Crawlerway.

2.4.3 DESCRIPTION. The facility consists of: an access canal, running west from the upper reaches of the Banana River; a turning basin; and docks on the west and north sides of the turning basin.

The access canal is provided for marine vessels which deliver launch vehicle stages, related components and other equipment and materials to LC-39. The turning basin is the terminal point for the barge vessels. It is 1,200 by 1,200 feet and will be maintained to a depth of 10 feet.

The dock facility is provided to receive and support barge vessels and their cargoes of launch vehicle stages, related components, equipment, and materials. The facility consists of: a barge dock to off-load launch vehicle stages and heavy equipment; 1,250 feet of docking space around the north and west periphery of the basin for material unloading; and a hard surfaced road from the dock to roads leading to all major areas of the launch complex.

2.5 LAUNCH CONTROL CENTER (K6-900)

2.5.1 FUNCTION. The Launch Control Center (LCC) (Figure 2-29) serves as the focal point for monitoring and control of vehicle checkout and launch activities associated with the Apollo/Saturn V Program.

2.5.2 LOCATION. The LCC is adjacent to the VAB. The distance from this structure to the center line of Pad A is approximately three miles.

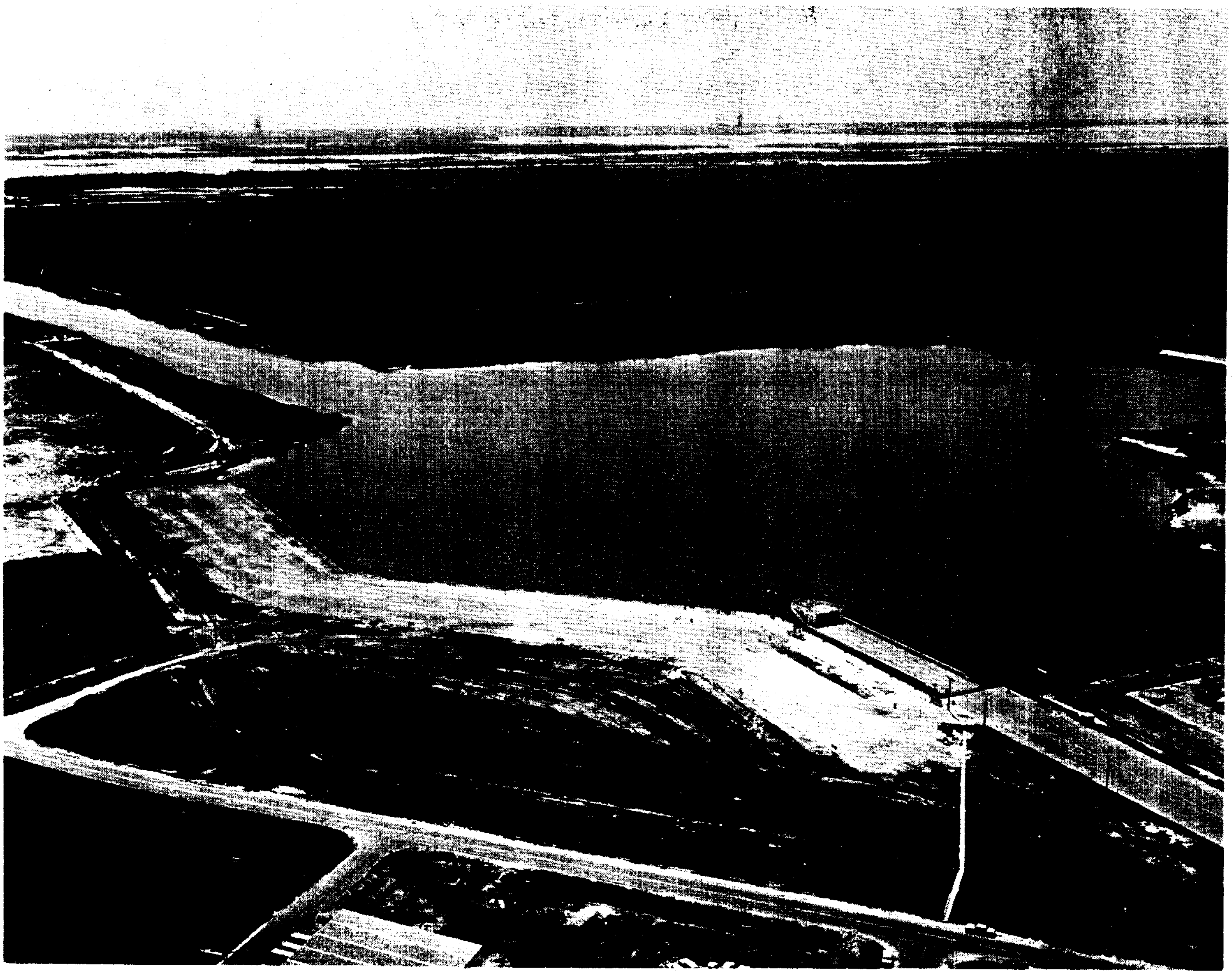


Figure 2-28. Launch Complex 39, Barge Terminal

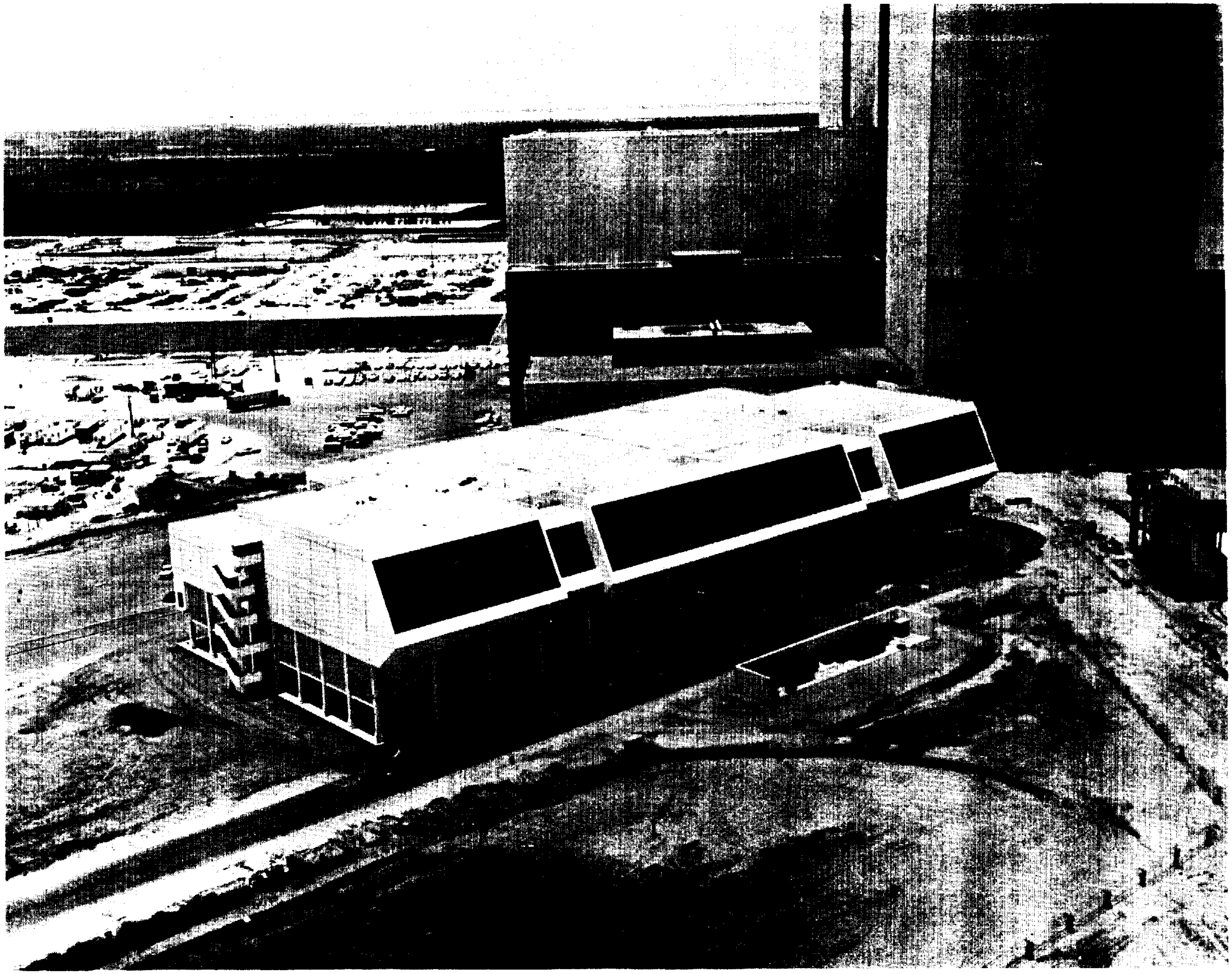


Figure 2-29. Launch Control Center

2.5.3 DESCRIPTION. The LCC is a permanent four-story structure. An enclosed personnel and cabling bridge connects the VAB and LCC at the third floor level. The base dimensions of the building are approximately 380 by 180 feet. The ground floor of the structure is devoted to service and support functions (cafeteria, offices, shops, laboratories, Communications Control Room, Complex Control Center, etc.). Telemetry, RF Tracking Equipment, Instrumentation, Data Reduction and Evaluation, etc., occupy the second floor.

The third floor is divided into four separate control areas that contain the following:

a. Firing rooms.
b. Computer room.
c. Mission control room.
d. Test conductor platform areas.
e. Visitor's gallery.
f. Office.
g. Main and distribution frame rooms.

The four firing rooms, one for each high bay in the VAB, contain control, monitoring, and display equipment required for automatic vehicle checkout and launch. Each firing room is supported by a computer room, which is a key element in the automatic checkout and launch sequence.

Direct viewing of the firing rooms and the launch area is possible from the building's mezzanine level through specially designed, laminated and tinted glass windows. Electrically controlled sun louvers are positioned outside the windows. Direct access to the VAB from the control areas is through the enclosed bridge. The display rooms, offices, Launch Information Exchange Facility (LIEF) rooms, and the mechanical equipment are located on the fourth floor.

The LCC has four elevators that can travel at 350 feet per minute. Provision is made for operation with or without attendant using local controls. Remote monitor/control is possible by use of the equipment in the Complex Control Center elevator panel.

The electronic equipment areas of the second and third floor have raised false floors. These floors are raised approximately one foot and six inches to allow for inter-cabinet/console cabling and cables between cabinets and interface frames and distribution panels. This area is used as the supply or return air-conditioning plenum or for duct work. The floor is designed for a live load of 200 pounds per square foot.

Fluorescent fixtures in the suspended ceiling illuminate the equipment areas of the first, second and third floors of the LCC. Selected fixtures throughout these areas are arranged for automatic transfer to the standby generator in the event of failure of the main power supply. As a supplement to this, emergency battery operated light units are strategically spotted throughout these equipment areas of the LCC. One passenger elevator is operable from the standby generator source in the event of failure of the main power supply.

The power system is split into two distinct power systems. The power demands in this area are large and consist of two types of loads; industrial and instrumentation.

The industrial power system supplies electric power for lighting, general use receptacles, air-conditioning, elevators, pumps, compressors and the like. The instrumentation power system supplies power to the electronic equipment, computers, and related checkout equipment. This system supplies power, as near free as possible, from switching transients, large cycling loads, and intermittent motor starting loads.

This facility is air-conditioned to provide an environment of 76 degrees FDB and 45 percent RH. This is accomplished by independent units and by air-handling units which obtain chilled and hot water from the Utility Annex.

Communication and signal cable provisions have been incorporated into the design of this facility. Cable troughs extend from the LCC via the enclosed bridge to each LUT location in the high bay. Cable troughs also extend to the buried cableways that connect the LCC with the LUT refurbishing areas and the PTCR at the launch pad.

2.5.4 COMPLEX CONTROL CENTER. The CCC is located on the first floor of the LCC. Its function is to provide a location from which LC-39 support systems can be monitored and controlled during space vehicle tests and operations.

The center contains consoles that provide the information necessary to allow observers to:

a. Monitor support systems.

b. Control the capacity of support systems (use 25, 50, 75 or 100 percent of the pumps of a pumping station).

c. Make "go/no-go" decisions about the ability of a system to support a test or operation.

Systems monitored at the CCC include:

a. Pad A industrial and Firex water pump stations.
b. Pad A fire alarm system.
c. Pad A and LUT HVAC.
d. LUT elevators.
e. Photographic cameras.
f. Industrial and emergency power systems.
g. Communications.
h. Propellants and ordnance.
i. Pneumatics.
j. Spacecraft and vehicle handling.
k. Others.

2.6 ORDNANCE STORAGE AREA

2.6.1 FUNCTION. The Ordnance Storage Area (Figure 2-30) serves LC-39 in the capacity of laboratory test area and storage area for ordnance items.

2.6.2 LOCATION. This facility is located on the north side of the Crawlerway and northeast of the VAB, approximately 2,500 feet. This remote site was selected for maximum safety.

2.6.3 DESCRIPTION. The ordnance storage installation enclosed by perimeter fence is comprised of: three arch-type magazines, two storage buildings, one ready-storage building, an Ordnance Test Building (Figure 2-31), and a guard service building. These structures are constructed of reinforced concrete, concrete blocks, and over-burdened where required. This facility contains approximately 10,000 square feet of environmentally controlled space. It provides for storage and maintenance of retrorockets, ullage rockets, explosive separation devices, escape rockets, and destruct packages. It also includes an area to test the electro-explosive devices that are used to initiate or detonate ordnance items. A service road from this facility connects to Saturn Causeway.

2.7 MOBILE SERVICE STRUCTURE

2.7.1 FUNCTION. The MSS (Figure 2-32) provides access to the space vehicle which cannot be serviced from the LUT while at the launch pad.

2.7.2 LOCATION. During nonlaunch periods, the MSS is located in a parked position along side of the Crawlerway, 7,000 feet from the nearest launch pad. Like the LUT, the MSS is transported to the launch site by the C/T where it is used during launch pad operations. It is removed from the pad a few hours prior to launch and returned to its parking area.

2.7.3 GENERAL DESCRIPTION. The MSS is approximately 402 feet high, measured from ground level, and weighs 12 million pounds. The tower structure rests on a base 135 feet by 135 feet. The top of the MSS base is 47 feet above grade. At the top, the tower is 87 feet by 113 feet.

2.7.3.1 Work Platforms. The structure contains five work platforms which provide access to the space vehicle. The outboard sections of the platforms open to accept the vehicle and close around it to provide access to the launch vehicle and spacecraft via these platforms. The movable sections of the platforms are actuated by hydraulic cylinders.

The lower two platforms are vertically adjustable to serve different parts of the launch vehicle. The upper three platforms are fixed but can be disconnected from the tower and relocated as a unit to serve different vehicle configurations.

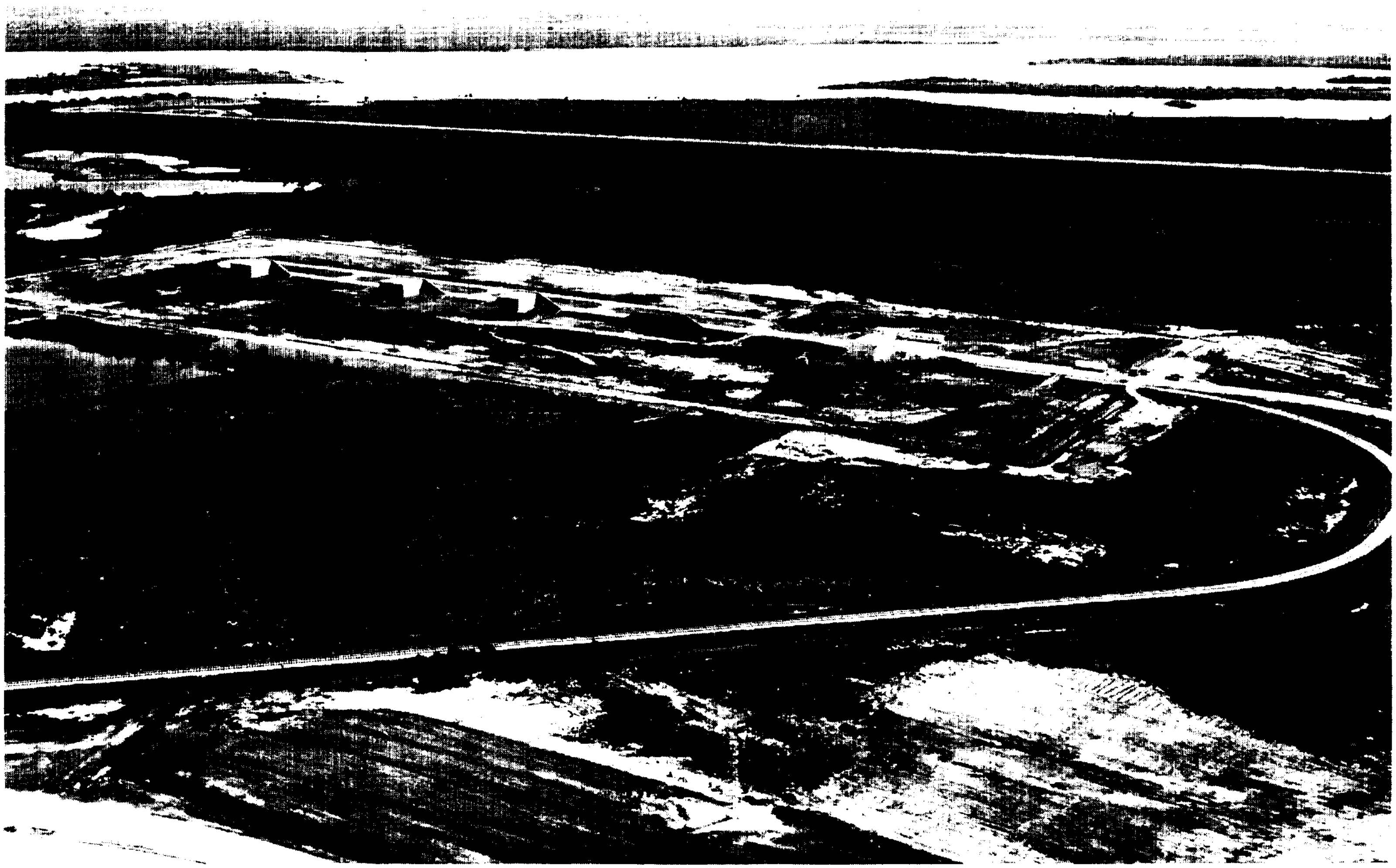


Figure 2-30. Launch Complex 39, Ordnance Storage Area

Figure 2-31. Launch Complex 39, Ordnance Storage Building

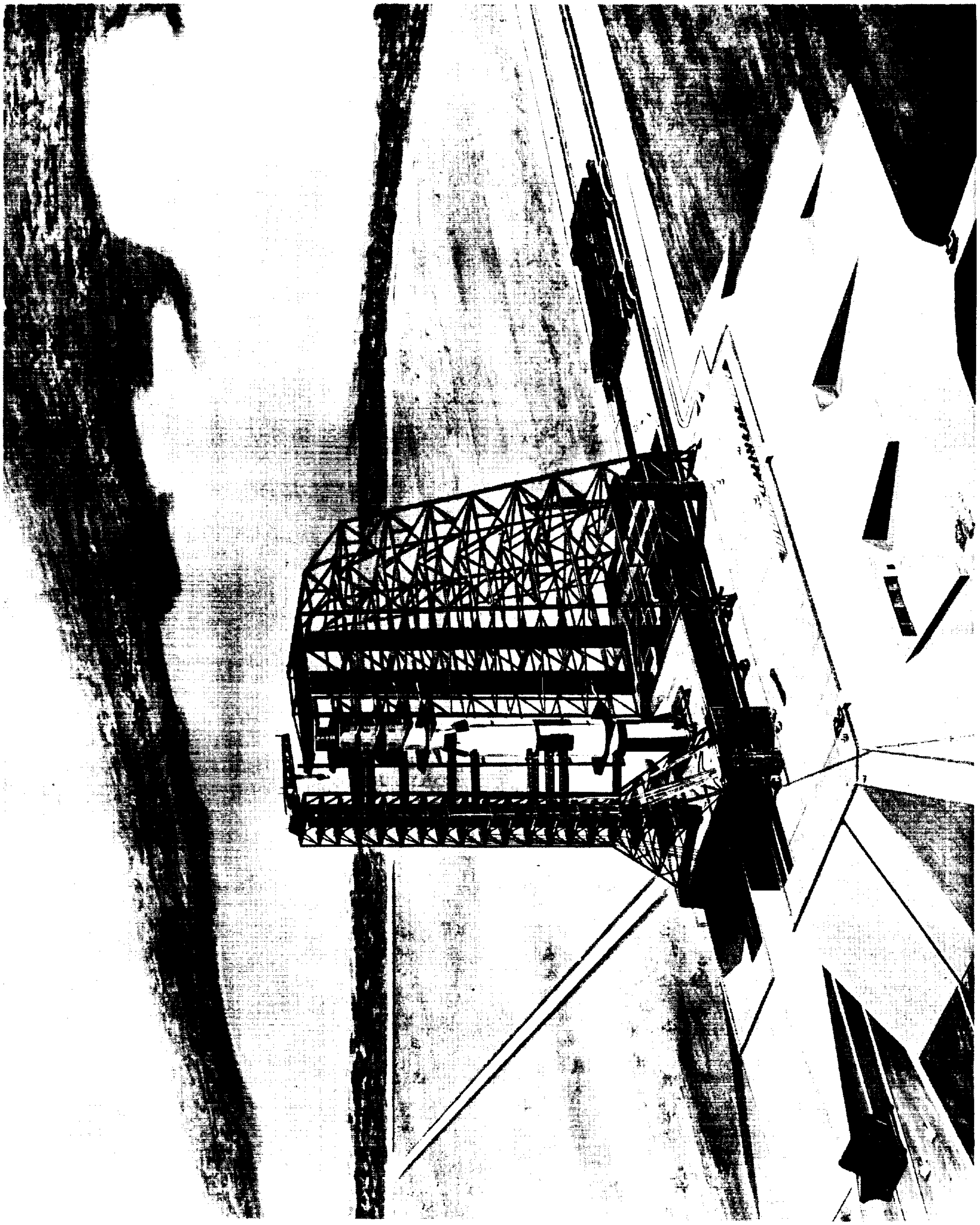


Figure 2-32. Mobile Service Structure (Concept)

The two lower platforms and the uppermost platform are open and bordered by a chain-link fence. The remaining two platforms are enclosed and will provide environmental control for the spacecraft.

2.7.3.2 Access. Access to various parts of the tower is provided by three elevators and one manlift. One elevator and the manlift provide access from ground level to the base work areas. Two elevators are high-rise combination passenger/freight types and serve the vehicle access platforms from the tower base. The elevators have local control for operation with or without attendant.

2.7.3.3 Base Buildings. The MSS contains the following buildings located at base level:

a. Mechanical Equipment Room.
b. Operations Support Room.
c. Sanitary Facility.
d. Elevator Equipment Room.
e. Communications and TV Equipment Room.
f. Electrical Equipment Room.
g. ACE Room at the 25-foot level (bottom of base truss).

2.7.3.4 Facility Systems. The MSS will contain air-conditioning, electrical power system, various communication networks, fire protection system, compressed air system, nitrogen pressurization system, hydraulic pressure system, potable water system, and spacecraft fueling system.

2.7.3.4.1 Air-Conditioning. The conditioned air for various parts of the MSS is provided by individual units. On the base platforms, the Communications Building and the Operations Support Building each have air-conditioning units. The remaining buildings have only ventilating units.

2.7.3.4.2 Electrical Power System. The power for the MSS is obtained from a 13.8-kv interconnect power pedestal located at the launch pad and park areas. During transit, the power required for elevators, hydraulic pumps, obstruction perimeter, and stairway lighting is supplied from the Crawler/Transporter. Two diesel-driven generators, 150-kw each, supply power in the event of power failure from the C/T or interface at the launch pad or park area.

2.7.3.4.3 Communications Networks. The MSS contains the following communications facilities:

a. Sound power telephone system. This system provides communication between the crawler cab, base platform buildings, and nine tower levels.

b. Telephone system. There is a regular telephone system serving the base platform rooms and nine tower levels.

c. Base paging system. The tower is connected to the base paging system. Loudspeakers are provided in the base platform rooms, ten tower levels, and work platforms No. 1, No. 2, No. 3, and No. 4.

d. Fire alarm system. The base platform buildings have heat activated sensors connected to the alarm system. Fire alarm bells and manual fire alarm stations are located on the base platform and nine tower levels.

e. Operational Intercommunication System (OIS). OIS facilities are provided on the tower base and on nine tower levels.

f. Operational Television System (OTV). OTV facilities are provided on five different levels for up to a total of twelve TV cameras.

2.8 CONVERTER/COMPRESSOR FACILITY (K7-468)

2.8.1 FUNCTION. The Converter/Compressor Facility (CCF) (Figures 2-33 and 2-34) converts liquid nitrogen to low pressure and high pressure gaseous nitrogen and compresses gaseous helium to 6,000 psig. The gaseous nitrogen and helium are then supplied to the storage facilities at the launch pad and at the VAB.

2.8.2 LOCATION. The CCF is located on the north side of the Crawlerway, approximately at the mid-point between the VAB and the main Crawlerway junction to launch pads A, B, and C (future).

2.8.3 DESCRIPTION. Facility and equipment of the CCF are:

a. One-story, permanent type structure, approximately 2,200 square feet (Maintenance - 2045, Office - 144).

b. Liquid nitrogen Dewar tank (500,000-gallon capacity).

c. Tank vaporizers.

d. Six 1,100 scfm - 6,000-psig high-pressure liquid nitrogen pump and vaporizer units.

e. Five 150 scfm - 6,000-psig high-pressure helium compressor units.

f. Two 230-gpm liquid nitrogen pumps.

g. One 230-gpm low-pressure liquid nitrogen vaporizer.

h. Helium and nitrogen gas drier/purifiers.

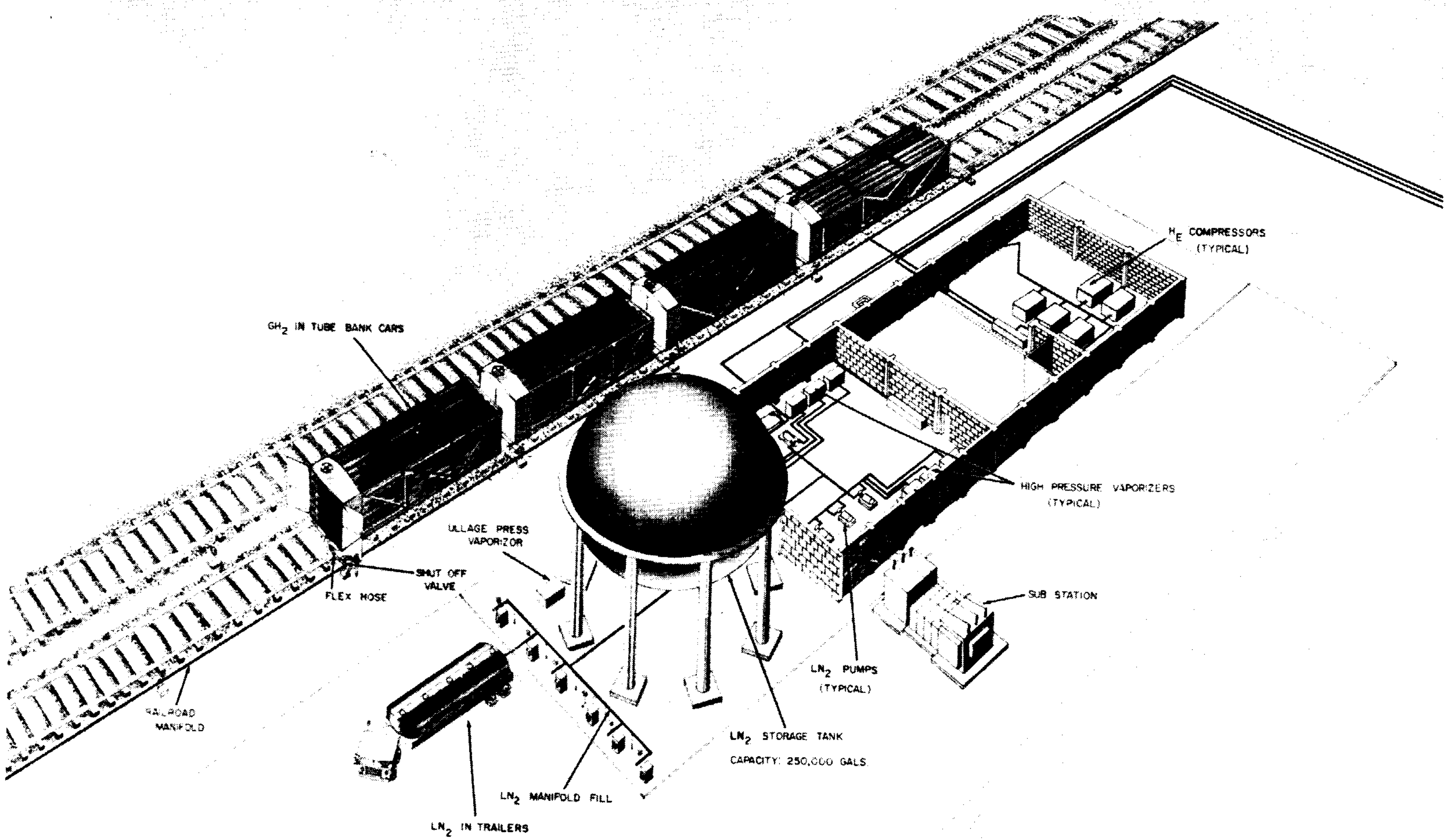


Figure 2-33. Converter/Compressor Facility (Concept)

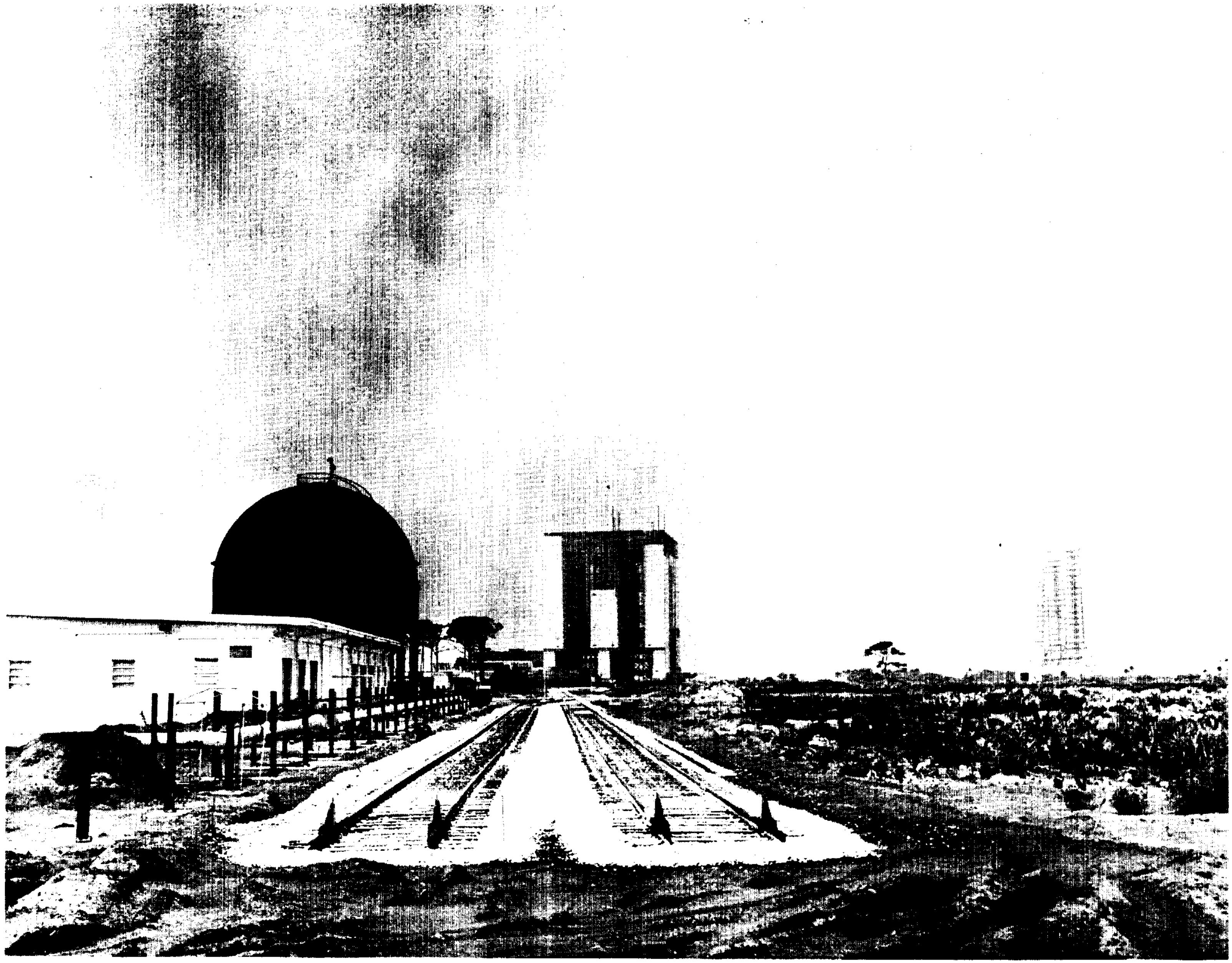


Figure 2-34. Converter/Compressor Facility Railroad Siding

i. Transfer facilities for liquid nitrogen and gaseous helium from transporter trucks and tube-bank rail cars, respectively.

j. Data link transmission cable tunnel.

The 500,000-gallon storage tank for the liquid nitrogen is located adjacent to the equipment building that houses the evaporators for conversion of the LH_2 to high-pressure gas. The liquid nitrogen is transferred to the vaporizer-compressors by pressurizing the storage tank. After vaporizing and compressing to 150 psig or 6,000 psig, the gaseous nitrogen is piped to the distribution lines supplying the VAB area (6,000 psig) and the pad (150 psig and 6,000 psig). The gaseous helium is stored in tube-bank rail cars. These are then connected to the facility via a common manifold and a flexible one-inch inside diameter high-pressure line. The helium passes through the CCF helium compressors which boost its pressure from the tube-bank storage pressure to 6,000 psig after which it is piped to the VAB and pad high-pressure storage batteries.

The CCF is air-conditioned to maintain 76 degrees $\pm$ 2 degrees FDB, and 50 percent $\pm$ 5 percent RH by a heat pump. Electrical power service to the CCF is by two "Industrial" power feeders from Switch Station No. 1A to a split primary bus 13.2 KC-227/480 v substation at the CCF. Industrial type fluorescent fixtures supply interior lighting.

Controls and displays are located in the CCF. Mas flow rates of high-pressure helium, high-pressure nitrogen, and low-pressure nitrogen gases leaving the CCF are monitored on panels located in the CCF. Transducers are used to sense the pressure and temperature of the gases in the high-pressure storage batteries.

Instrumentation cables carrying signal data are routed through the instrumentation terminal distributor located in the CCF via cableway ducts running between the CCF and the VAB, LCC, and launch pad.

2.9 INSTRUMENTATION BUILDING (K7-1557)

2.9.1 FUNCTION. The Instrumentation Building (Figure 2-35) houses the ODOP transmitter.

2.9.2 LOCATION. The building is located on Instrumentation Road, south of Saturn Causeway.

2.9.3 DESCRIPTION. The one-story building is approximately 36 feet by 90 feet. The rooms consist of an office, workshop and laboratory, record storage room, communications room, mechanical equipment room, and a main operations room. The operations room is RF-shielded. This room is approximately 34 feet by 48 feet. A 200-foot antenna tower is located approximately 50 feet south of the building.

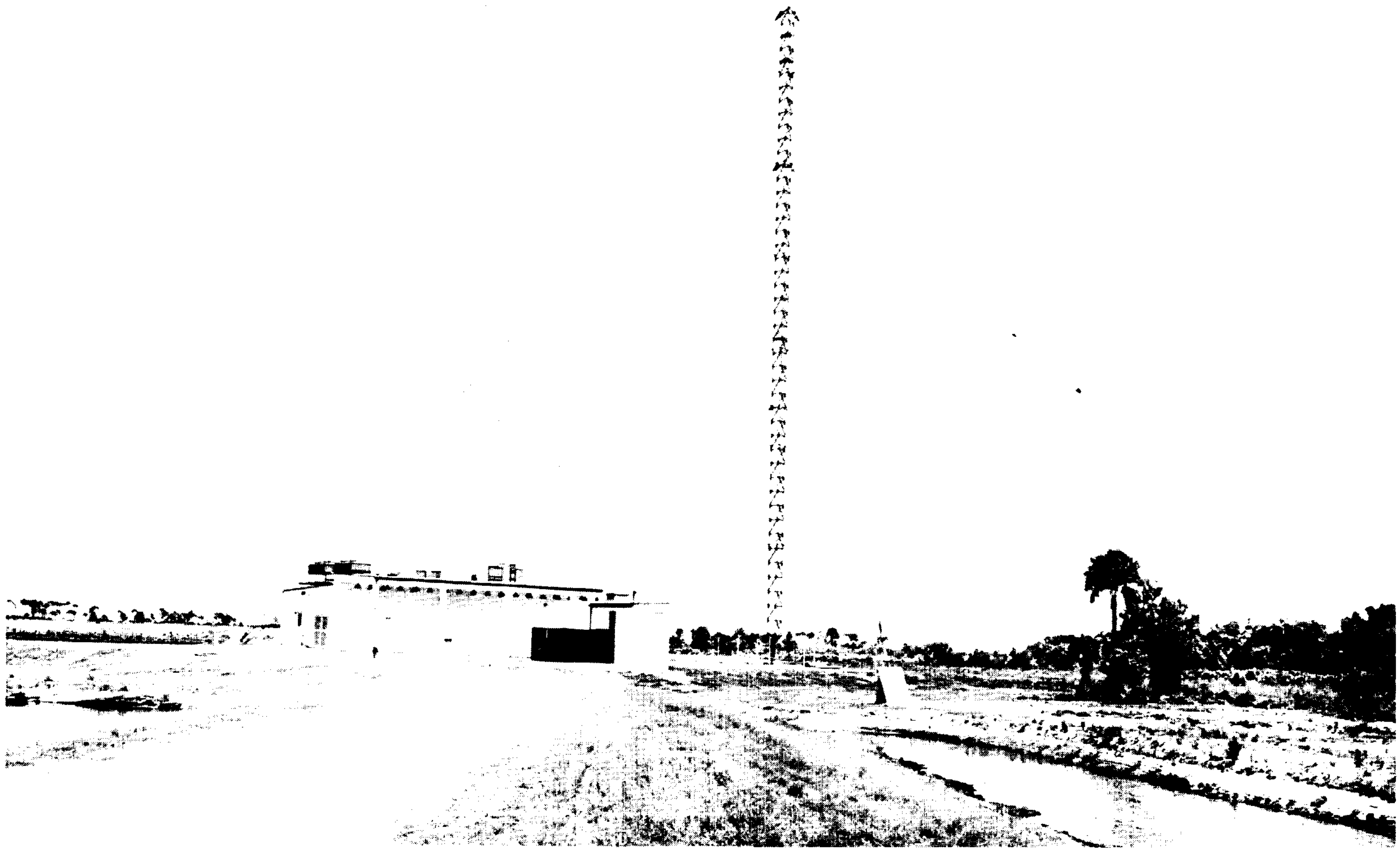


Figure 2-35. Instrumentation Building and Antenna

2.10 CRAWLERWAY

2.10.1 FUNCTION. The Crawlerway (Figure 2-36) serves as the roadway for movement of the Crawler/Transporter between the VAB, launch pad, MSS park area, and LUT refurbishment area.

2.10.2 LOCATIONS. The Crawlerway extends from the east and west high bay doors of the VAB to the launch support structure at the pad with branches serving the MSS park area and the LUT refurbishment area.

2.10.3 DESCRIPTION. The Crawlerway is approximately three miles long between the VAB and Pad A. It consists of two surfaces, separated by a 50-foot wide median. Each surface consists of three to four feet of crushed limestone paved with asphalt, sealed and covered with gravel, and is 40 feet wide; the total process thickness is 6 feet 6 inches. On one side of the Crawlerway is a 24-foot wide access road; on the other side are located supports for high-pressure gas lines from the CCF to the VAB and pad, underground power ductway, communication and instrumentation ductway, and an 18-inch water main. Other structures located along the Crawlerway are the Data Link Transmission Repeater Buildings, High-Pressure Gas Converter/Compressor Facility (CCF), and Mobile Service Structure park position, which contains foundation, supporting arms, and utilities.

2.11 SPECIAL FACILITY SYSTEMS

2.11.1 HIGH INTENSITY LIGHTING SYSTEM. The High Intensity Lighting System supports instrumentation and documentary photography, and the Operational TV System in areas where normal lighting is insufficient for these operations. Activities, requiring high intensity lighting support, include unloading and transportation of units to the VAB, spacecraft assembly and checkout, vehicle checkout and mating within the VAB, transportation of the vehicle from the VAB to the pad, and launch operations. The high intensity lighting system will provide daylight quality illumination in areas where color photography is required.

High intensity lighting utilizes fixed, portable, and mobile equipment to meet the photographic requirements.

2.11.1.1 VAB Lighting. Normal building lighting in the lower VAB areas will generally be sufficient for photographic operations. However, on and above the 160-foot level, additional lighting is required. This supplemental lighting is provided by fixed floodlights and portable lights on the LUT.

The fixed floodlights on the LUT will be utilized while in the VAB. These floodlights provide illumination to the service arms and deck area. These are the same lights as those used to support launch photography.

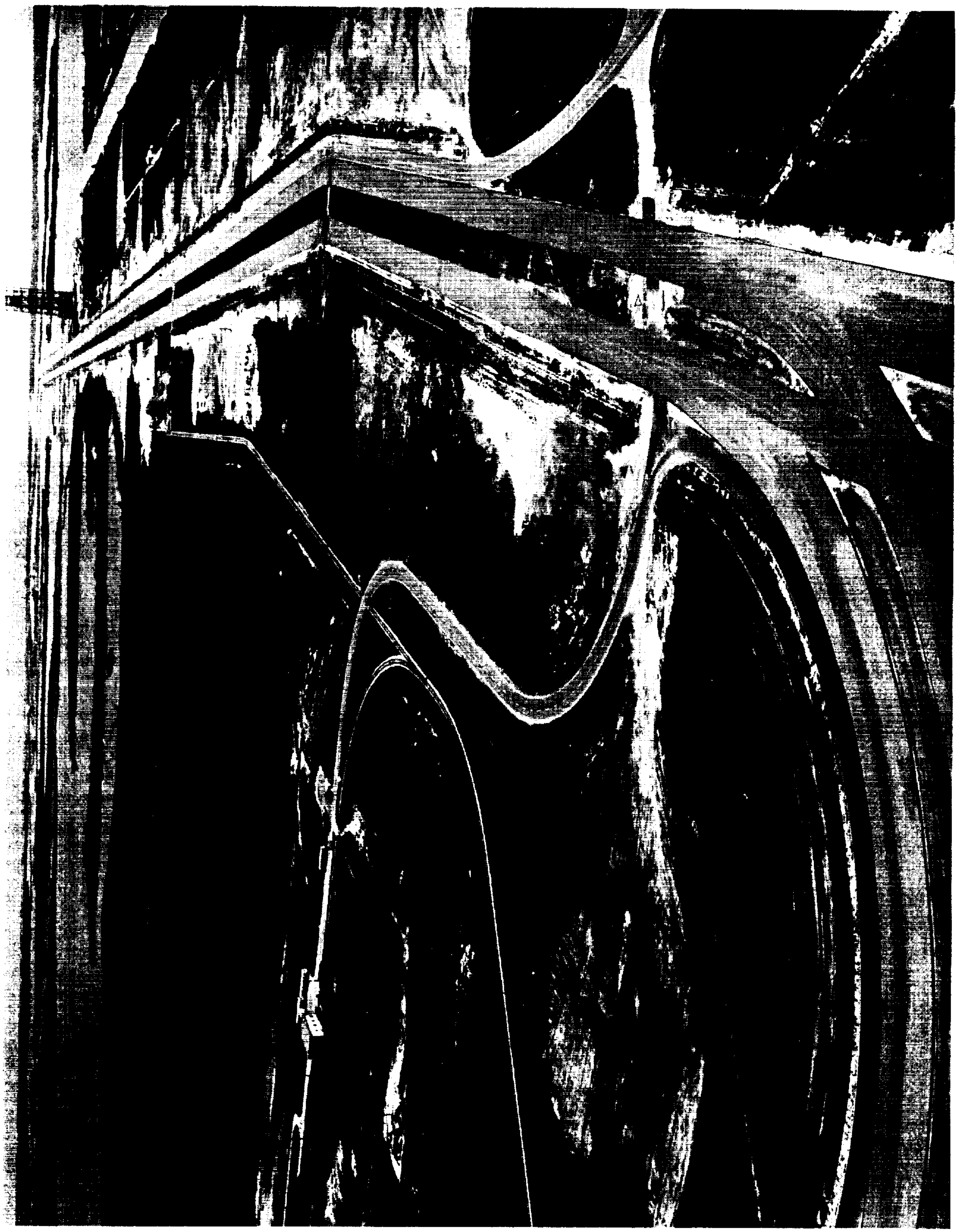


Figure 2-36. Crawlerway (Looking East)

Portable lights consist of adjustable floodlights mounted on a folding tripod base. These are easily moved and are adjusted on location as required. These units have a 45-foot beam diameter and a 50-foot minimum working distance.

Mobile floodlight units are also available for use as required in the VAB.

2.11.1.2 Vehicle Launch Area Lighting. While on the launch pad, the principal vehicle photographic lighting is provided by the fixed floodlights on the LUT and the pad perimeter searchlights.

Fixed floodlights on the LUT provide lighting primarily for the service arms, deck area, and the flame pit. These floodlights are explosion proof and are capable of withstanding the intense heat during launch.

Pad perimeter searchlights are placed in a minimum of three positions around the pad perimeter approximately 1,300 feet from the vehicle and operate from 480-volt, 8-phase, 60-cycle power. Each searchlight array is capable of:

a. Tracking the vehicle for the first 1,300 feet of flight, by means of a servo-controlled drive mechanism that rotates the lamps about an elevation axis.

b. Automatically controlling lamp intensity which is a function of the arrays elevation angle.

c. Being controlled locally or remotely.

Thus the searchlight units provide uniform light intensity on the vehicle up through the first 1,300 feet of flight.

2.11.1.3 In-Transit Lighting. Unit unloading and transfer will not normally be scheduled as night operations. However, it is probable that unexpected delays may require night operations, for which mobile high-intensity lighting is provided.

Crawlerway activities include transfer of the space vehicle from the VAB to the pad, transfer of the MSS to and from the pad, and return of the LUT to its refurbish area. Some of the operations will occur at night, for which mobile high-intensity lighting is provided.

Mobile high-intensity lighting is provided by a trailer-mounted wide beam floodlight array. Each array is capable of illuminating an area fo 50 feet high by 100 feet wide from a minimum distance of 100 feet. The array has both mounting height and elevation angle adjustment, and operates from 480-volt, 3-phase, 60-cycle power. The trailer-mounted unit is capable of operation while being towed at slow speeds; power for the lights is supplied by the towing vehicle. The light fixtures are explosion proof and can be operated in hazardous locations.

2.11.2 OPERATIONAL INTERCOMMUNICATION SYSTEM. The Operational Intercommunication System (OIS) is the primary voice communication medium used for coordinating the preparation, checkout, countdown, and launching of space vehicles.

Three types of systems are used, these are: the Radio Frequency-Operational Intercom System (OIS-RF), the Audio-Operational Intercom System (OIS-A) and the Operational Paging System.

2.11.2.1 Radio Frequency-Operational Intercom System (OIS-RF). The OIS-RF System is a 112-channel, single-sideband suppressed-carrier, frequency-multiplex intercommunication system. Each station of the system may select any one channel for voice duplexing and another channel for sidetone monitoring. Voice operated transmission control is also provided.

The hub of the OIS-RF System is the Communications Control Center located in the LCC. From the LCC, distribution of coaxial and wideband cable extends to 22 Local Communications Areas (LCA) and their operator stations. The Communications Control Center provides a master pilot tone on the cable to the LCA's. A pilot tone is required for the OIS-RF frequency multiplexing. The Communication Control Center also contains the following OIS-RF equipment:

a. UHF radio (10 channels of the OIS-RF).
b. 112-channel baseband recorders.
c. Selective channel recorders.
d. Fault alarm and display.
e. Remote control for activating or isolating LCA's.
f. Interface to Operational Paging System.
g. Interface to OIS-A.
h. Interface to communications systems external to LC-39.
i. Emergency OIS-RF power.

Selected operator stations have an all-call transmit capability. This permits the operator immediate access to every station in the system.

2.11.2.2 Audio-Operational Intercom System (OIS-A). There are two types of Audio Intercom Systems, a 21-channel and a 2-channel system.

2.11.2.2.1 21 Channel OIS-A. The 21 channel OIS-A systems are installed on KSC (not programmed for LC-39). This type of OIS-A is designed around high-gain, solid-state amplifiers and utilizes multiconductor cable for transmission. A widerange automatic-gain-control is built into the operator instrument preventing unnecessary volume adjustments. This OIS system is compatible with other communication systems.

2.11.2.2.2 Two Channel OIS-A. The two channel OIS-A is provided for LC-39. This system contains 23 networks with approximately 300 operator stations. The system incorporates the features of 21 channel OIS-A and also includes a supervisory call indicator.

2.11.3 OPERATIONAL PAGING SYSTEM. The paging system provides paging service on KSC. It incorporates inputs from a central paging console, with selective access to various operational and administrative zones. The paging system utilizes selected channels of the Operational Intercom System-RF for interconnection of those buildings served by OIS-RF.

The paging system includes an audio system which provides speech reinforcement of speaker and audience activities and magnetic tape recording of these activities. The audio system has playback capability for magnetic tape, motion picture sound track, and other external sources of audio. It is designed so that all of these functions may be simultaneously "conferenced" with similar systems at remote locations, over leased commercial telephone lines.

The paging system, including the Mission Briefing Room (MBR) Audio Systems, incorporates circuitry to allow automatic switching between dual power amplifiers in the event of failure of either amplifier. The remaining amplifier shall assume the full load at a reduced level.

Both of the systems are equipped with a seizure feature that will pre-empt normal system usage upon a signal from the KSC override circuit.

Paging system capabilities include:

a. Providing paging capability from dispatcher console to any LC-39 administrative and operational areas.

b. Providing control circuitry to allow seizure of all control points from a remote location, at the discretion of KSC override.

c. Providing paging capability from the selected test conductor location to override the dispatcher paging. The system has the capability of preprogramming areas to receive emergency paging of a test conductor.

The paging system is controlled from a dispatcher console. The operator uses a small, modular desk-top panel, with back-lighted indicators, to allow access of the control position to any KSC zones. The system design provides for initial connection of this panel to twenty-two zones, plus an "all-call" position. Seven additional positions will be used in the future for building modifications, zone changes, special requirements, etc. The desk-top panel will also contain a visual indicator to show priority seizure by the KSC override system and the test conductor.

The power amplifier racks for individual zones are located in the telephone equipment rooms within these zones. This arrangement simplifies distribution to the various loudspeaker locations, as well as isolating system elements in the case of component failure causing failure alarm. Interconnection of the control points to their associated power amplifier racks shall be made at a zero decibel level (reference one milliwatt across 600 ohms) through the existing inside telephone plant.

2.11.4 OPERATIONAL TELEVISION (OTV). The OTV (Figure 2-37) system provides for the visual monitoring of hazardous or inaccessible operations during LC-39 vehicle assembly, checkout and launch. The system consists of cameras, camera control units, video programming/switches boards and monitors. The system is controlled from the Communications Control Room (CCR) in the LCC. All switching and patching is performed in this room. The Firing Rooms send picture change requests by OIS to the CCR. In the Firing Rooms, a total of 60-monitor displays can be viewed at one time. Display signals can originate at the VAB high bay ext. platform 1 or 2, the LUT, the MSS and/or Pads A or B. The LUT, MSS, and the pad cameras are remotely controlled from the camera control unit located in the camera room in the LCC. The LUT has 27 TV cameras, the MSS has 12 TV cameras, the pads have 12 TV cameras and the VAB high bay has 5 TV camera locations, each on platforms No. 1 and No. 2. There are five channels available from the VAB high bay to the CCR.

2.11.5 POINT-TO-POINT COMMUNICATIONS. The point-to-point telephone system allows direct communication between key personnel during tests and operations. Persons requiring this service are supplied phones with exclusive interconnecting lines. The point-to-point system is used within KSC and AFETR, and by the use of reserved tie-lines, connects KSC with other NASA organizations.

2.11.6 POWER CONTROL AND DISTRIBUTION. The electrical power system supplies electrical power to the facilities and equipment located throughout LC-39.

Reliability is enhanced by providing most areas with dual feeds. Provision is made to isolate critical instrumentation from surges connected with industrial type loads.

Centralized remote control and monitoring provides the capability to monitor and remotely control vital parts of the power system, especially in areas which must be left unmanned during the period just prior to launch. This control includes both normal and emergency power in the 69-kv main substation (Figures 2-38 and 2-39), the VAB and vicinity, and Pad A and vicinity. Centralized remote control and monitoring is a function of the CCC at the LCC.

Emergency power sources are provided for critical loads where loss of power would create hazards, cause severe inconvenience, or cause loss of life or equipment. These loads include critical lighting in hallways, stairways clearance lights, elevators, fire alarm system, public address system, sump pumps, etc.

2.11.6.1 General Description. Electric power for LC-39 originates at the 69-kv main substation located on the west side of Kennedy Parkway, opposite the VAB area.

Power is supplied to this substation by the Florida Power and Light Company 69-kv incoming transmission line (Figure 2-38).

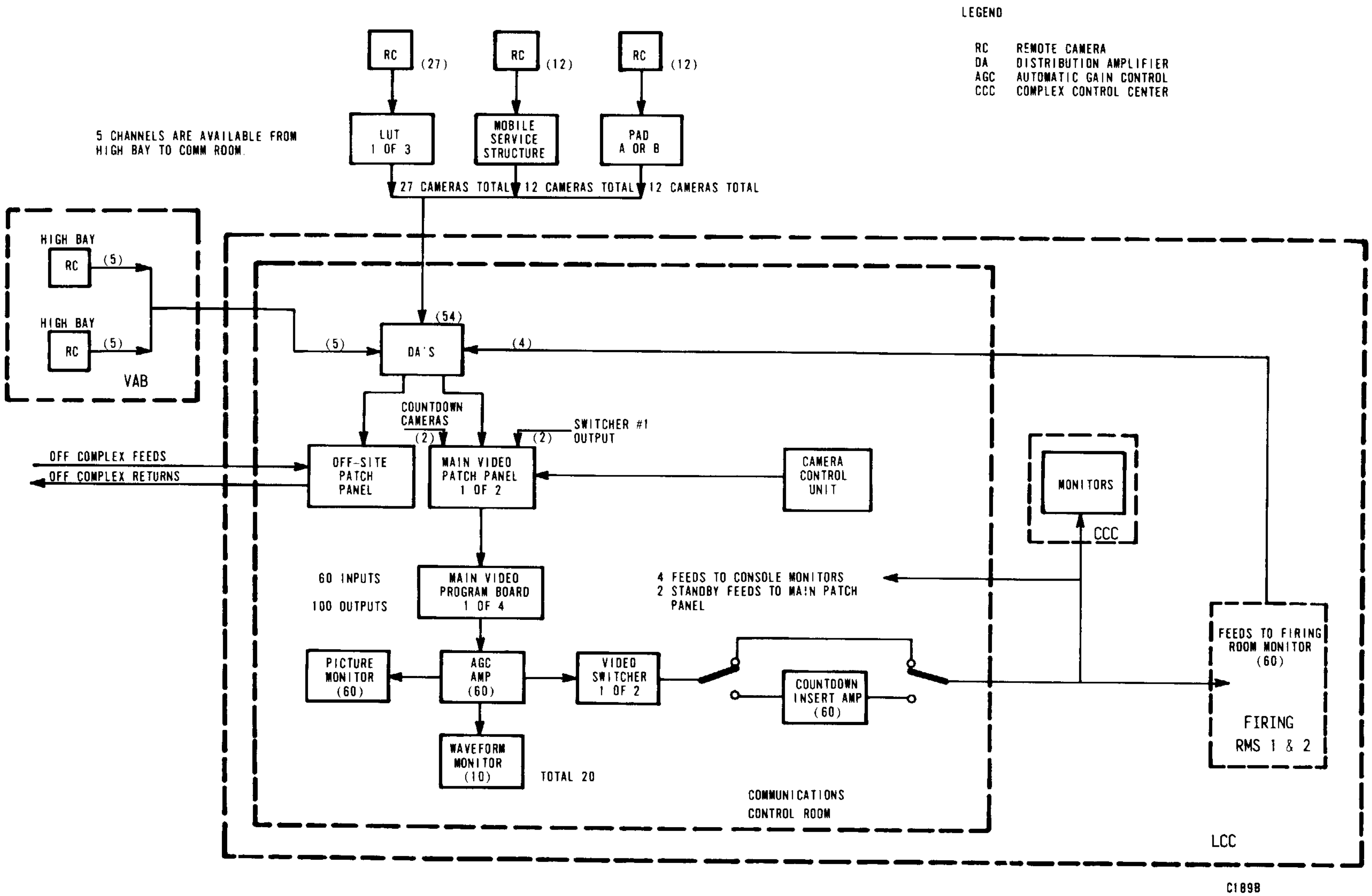


Figure 2-37. Launch Complex 39, Operational Television (OTV) System (Block Diagram)

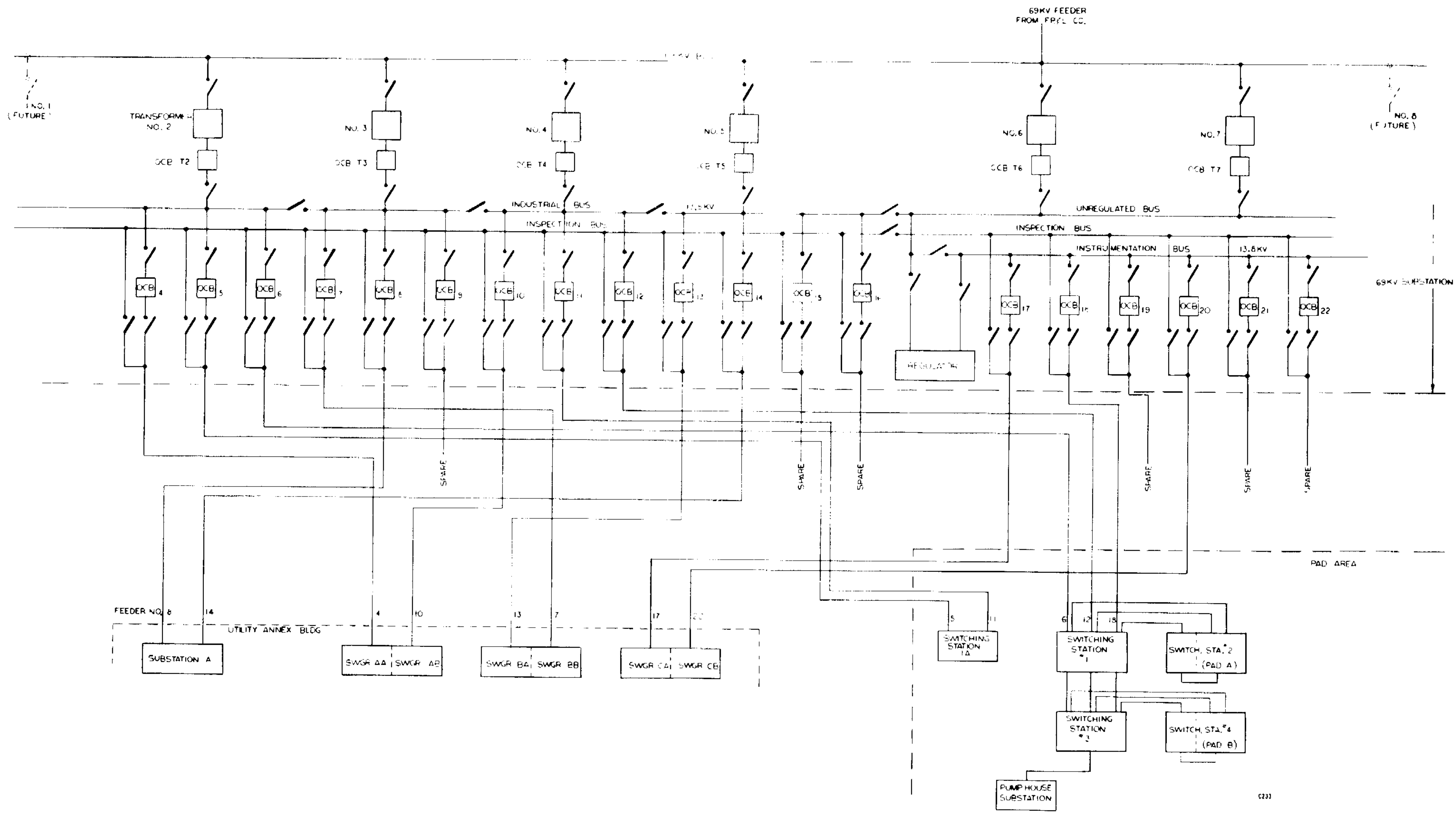


Figure 2-38. Launch Complex 39, 69 KV Substation and 13.8 KV Power Distribution (Block Diagram)

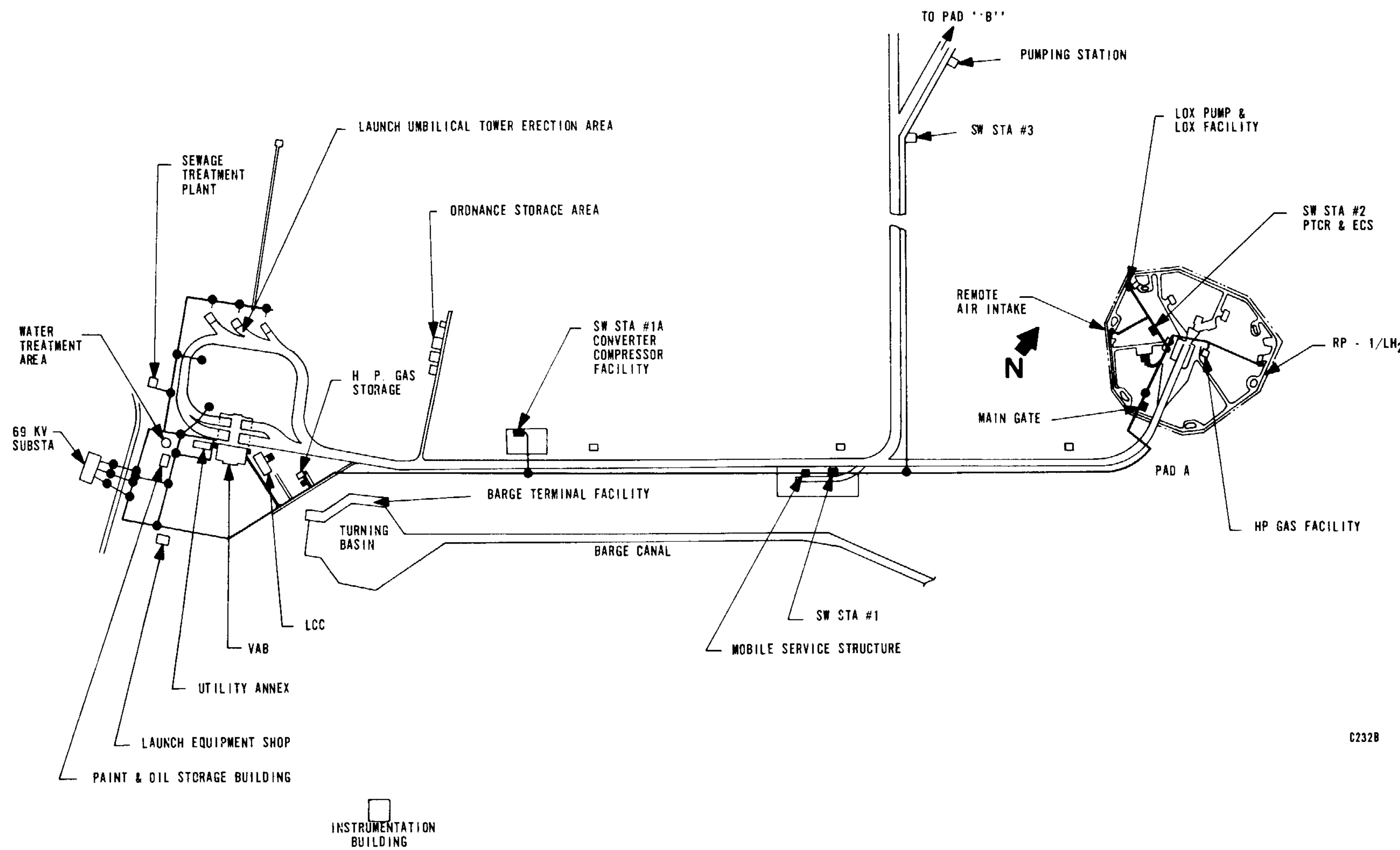


Figure 2-39. Launch Complex 39, Power Distribution System

The main 69-kv substation steps the voltage down to 13.8 kv on both the industrial bus and the instrumentation bus. These buses are normally isolated from one another, but can be connected in an emergency. The 13.8-kv feeders originating in the main 69-kv substation carry commercial electrical power to the various LC-39 areas (Figure 2-39.)

2.11.6.2 Utility Annex. Three-phase, 13.8-kv power is supplied to three switchgear assemblies and a 4160-v substation at the Utility Annex (Figure 2-40.)

The three switchgear assemblies each have a divided bus fed by a separate feeder. Should one feeder be lost, a switch is closed to connect the two bus sections together, feeding both sections from one feeder. There is no interconnection between the three switchgear assemblies. Two of the assemblies are connected to the industrial system and one is connected to the instrumentation system.

The switchgear assemblies are used to control the supply of 13.8-kv power to substations throughout the VAB area. The connections are made so that a given substation receives power from two distinct sections of the switchgear. This provides greater reliability to the power distribution system.

A dual substation in the Utility Annex supplies the power for loads in the Annex. This substation is fed 13.8-kv power from the switchgear assemblies in the Annex. Each transformer feeds one bus. These buses are connected together, should one transformer be unable to supply power. Power is supplied at 480 v to loads or to transformers should a reduced voltage be required.

The dual 4160-v substation accepts power from two 13.8-kv feeders and supplies three-phase, 4160-v power to motor control centers which, in turn, supply power to large refrigeration system motors.

Emergency power for the VAB area is supplied by a diesel generator in the Utility Annex. This generator starts automatically when normal power is lost.

An automatic throw-over switch (Figure 2-41) in the 13-kv switch cubicle transfers the essential feeder to the emergency system generator. When normal power is restored, a sequence is initiated to return the essential feeder to the normal power system.

Emergency power in the Utility Annex is distributed by a substation which is fed by the essential feeder. Critical loads are fed at all times from this substation with exception of the elevator, which is automatically connected when normal power is lost.

2.11.6.3 VAB. Industrial power 13.8-kv and instrumentation power (Figure 2-42) is supplied to oil switches in the VAB from the switchgear assemblies in the Utility Annex. These oil switches supply power to substations located throughout the VAB. These oil switches also feed power to several other facilities in the VAB area.

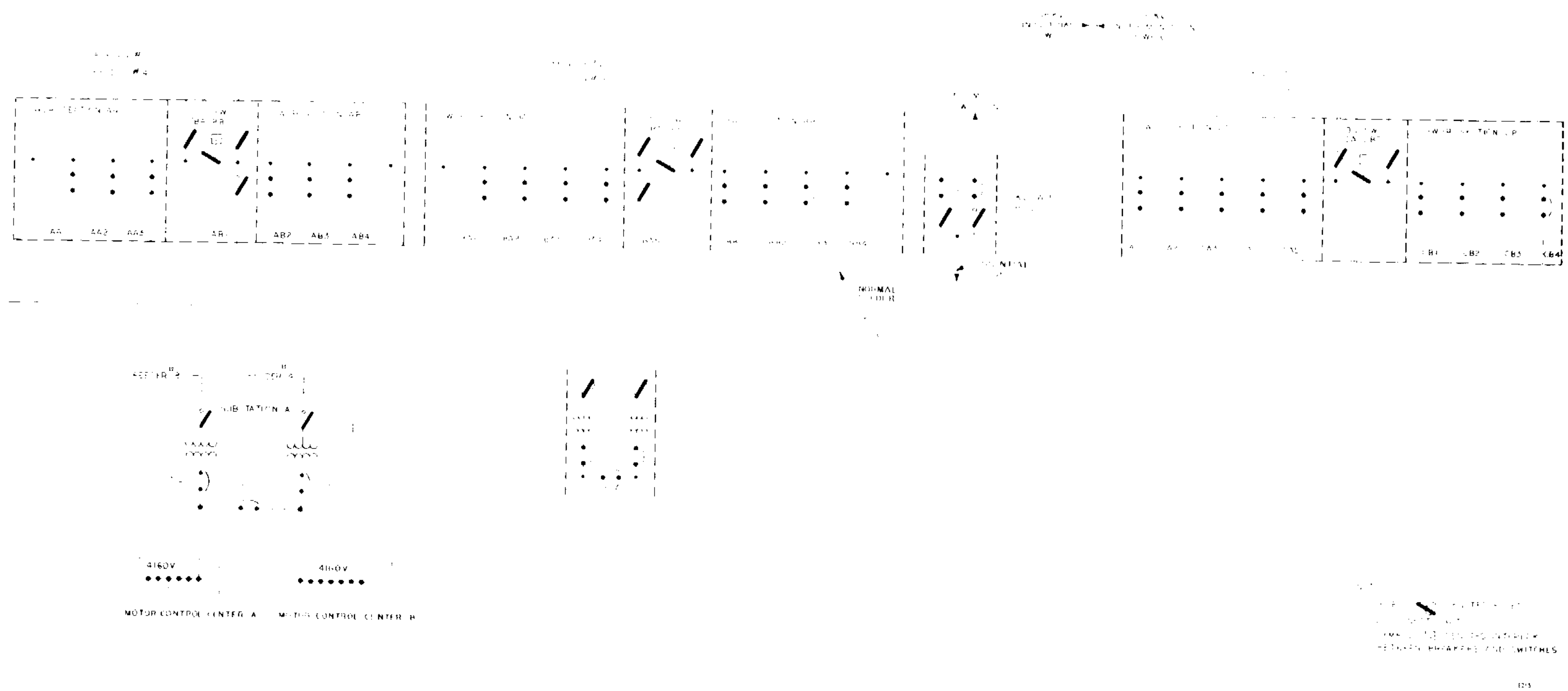


Figure 2-40. Utility Annex, Industrial and Instrumentation Power Distribution (Block Diagram)

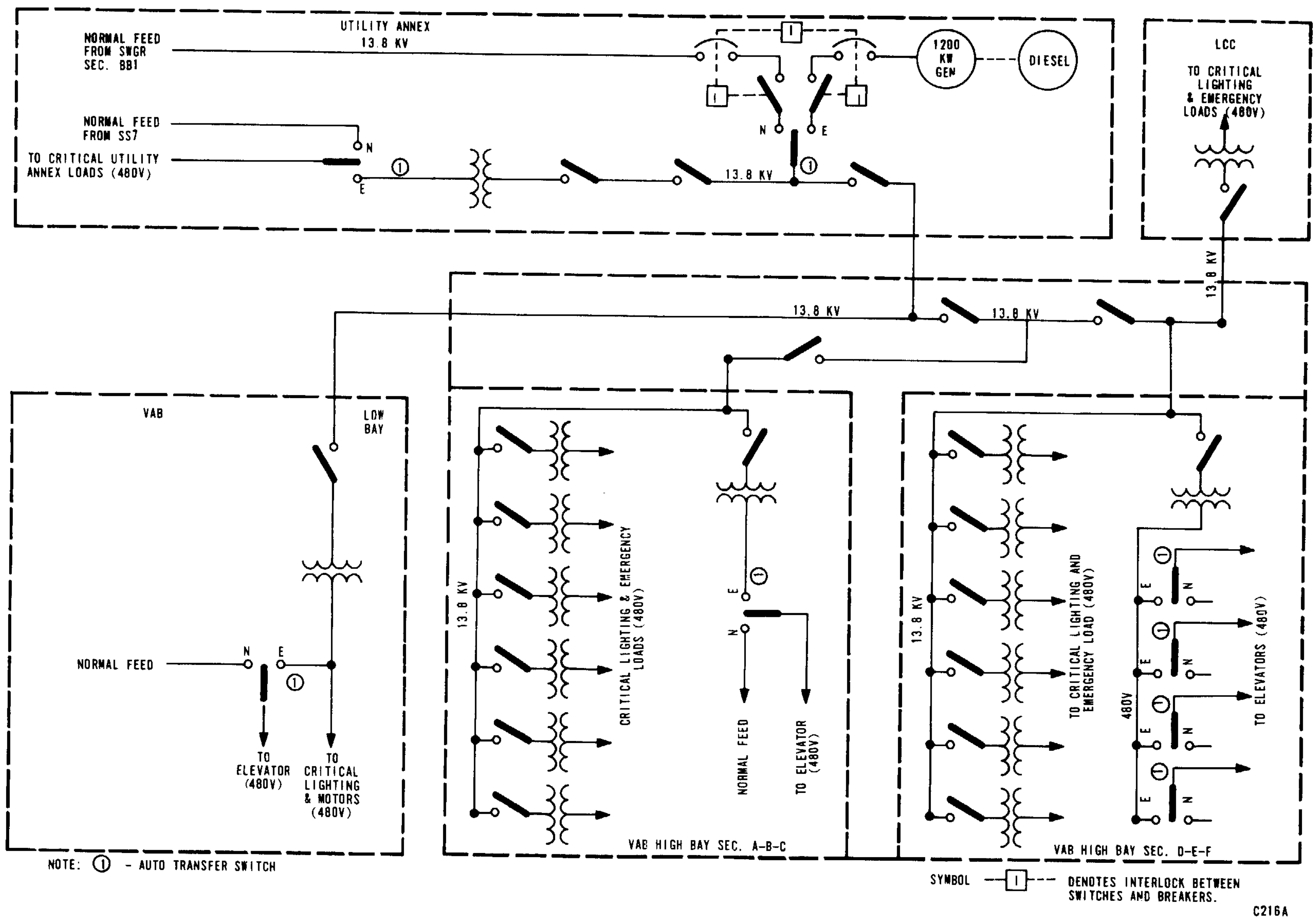


Figure 2-41. Launch Complex 39, Assembly Area Emergency Power Distribution (Block Diagram)

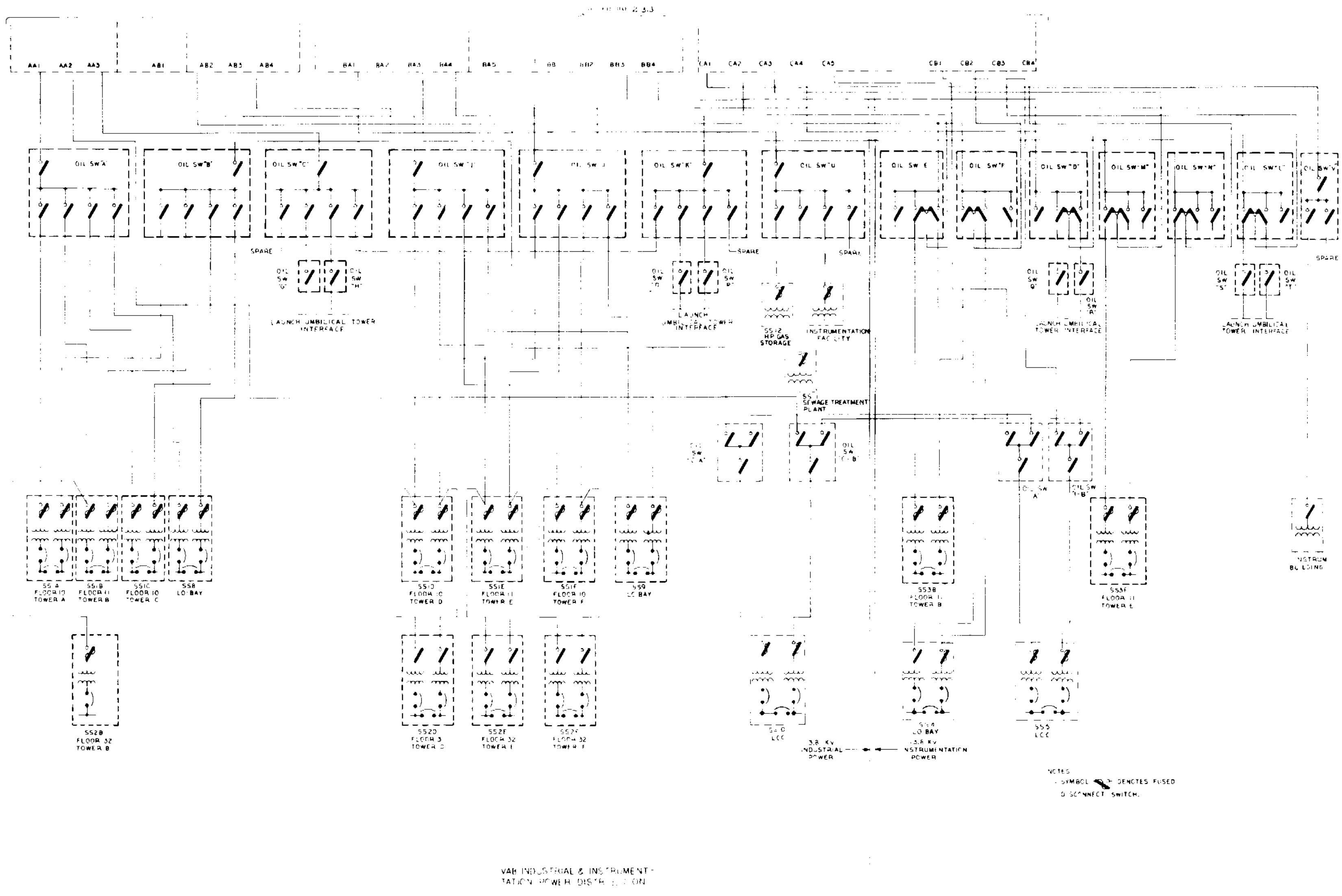


Figure 2-42. Launch Complex 39, Assembly Area Industrial and Instrumentation Power Distribution (Block Diagram)

Each substation has two feeds and two identical transformers. The two transformers feed separate buses that can be connected together should one transformer be unable to supply power. Power is supplied to loads at 480 v.

Pedestals in the VAB provide instrumentation and industrial power at 13.8 v for the LUT's while located in the VAB.

Emergency power for the VAB (Figure 2-41) is supplied from the diesel generator in the Utility Annex by the essential feeder. The essential feeder supplies emergency power to substations throughout the VAB. These substations supply buses to which critical loads are connected at all times. Elevators are automatically connected to these buses when normal power is lost.

2.11.6.4 Launch Control Center. Power is supplied to the LCC industrial and instrumentation substations from oil switches located in the VAB. This three-phase, 13.8-kv power is supplied to two identical transformers in each LCC substation which, in turn, feed a divided 480-v bus. These buses can be interconnected should one of the transformers be unable to deliver power. Should an instrumentation feeder be lost, the instrumentation substation is connected to one of the industrial feeders.

Emergency power is supplied from the diesel generator in the Utility Annex by the essential feeder which comes through the VAB. This feeder supplies a substation in the LCC which, in turn, feeds the critical loads. Critical loads include lighting in corridors and stairways, obstruction lights, sump pumps, and one elevator.

2.11.6.5 Paint and Storage Area. The Paint and Storage Area is supplied 480-v power from the Utility Annex. It is transformed down to 120/208 v to meet area needs.

No emergency power is supplied to this area.

2.11.6.6 Water Treatment Area. The Water Treatment Area is supplied 480-v power from the Utility Annex.

2.11.6.7 Sewage Treatment Plant. Three-phase 13.8-kv industrial power is supplied to the Sewage Treatment Plant from oil switches in the VAB. A substation in the Sewage Treatment Plant supplies power to the loads at 480 v.

No emergency power is supplied to the Sewage Treatment Plant.

2.11.6.8 VAB High-Pressure Gas Storage Area. Three-phase 13.8-kv industrial power is supplied to the High-Pressure Gas Storage Area from oil switches in the VAB. A substation in the High-Pressure Gas Storage Area supplies power to the loads at 480 v.

2.11.6.9 Ordnance Storage Area. Power is supplied at 480 v to the Ordnance Storage Area from the substation in the High-Pressure Gas Storage Area.

No emergency power is supplied to the Ordnance Storage Area.

2.11.6.10 Barge Terminal Facility. Power is supplied at 480 v to the Barge Terminal Facility from the substation in the High-Pressure Gas Storage Area.

No emergency power is supplied to the Barge Terminal Facility.

2.11.6.11 Launch Equipment Shop. Three phase 13.8-kv industrial power is supplied to the Launch Equipment Shop from oil switches in the VAB. A substation supplies the required voltage to the loads.

No emergency power is supplied to the Launch Equipment Shop.

2.11.6.12 LUT Erection Area. This area is served three-phase 13.8-kv power by an overhead line from the 69-kv main substation. A substation in the area supplies the required voltage to the loads.

2.11.6.13 Instrumentation Facility. Three-phase 13.8-kv industrial and instrumentation power is supplied to substations in the Instrumentation Facility (Figure 2-43) from oil switches in the VAB. The substations supply 120/208-v power to the instrumentation bus and the industrial bus.

Emergency power in the Instrumentation Facility is supplied by a 250-kw, 120/208-v diesel generator located in the facility. Upon loss of normal power, the generator is automatically started and is automatically connected to the instrumentation bus. A portion of the industrial bus can be manually connected to the emergency generator to maintain critical air conditioning.

2.11.6.14 Converter/Compressor Facility. Three-phase 13.8-kv industrial power (Figure 2-44) is supplied over two feeders to Switching Station No. 1A which, in turn, supplies power to three substations in the facility. The 480-v bus in each substation can be connected to the bus of the adjacent substation in the event a transformer should fail; however, the reactors used in the gas conversion process draw a heavy load, and only one reactor can be used when a single transformer is supplying power to two buses.

The substations supply loads at 480 v. In addition to the gas converter, power is also supplied to Data Link Repeater Buildings 1 and 2.

Emergency power for CCF lighting is supplied by batteries.

2.11.6.15 Mobile Service Structure Park. Three-phase power is supplied to the substation. Two 13.8-kv feeders, Nos. 6 & 8, supply the two industrial buses. One 13.8-kv feeder supplies the instrumentation bus. Switching Station No. 1 (Figure 2-45) supplies industrial power to the Mobile Service Structure park. The three

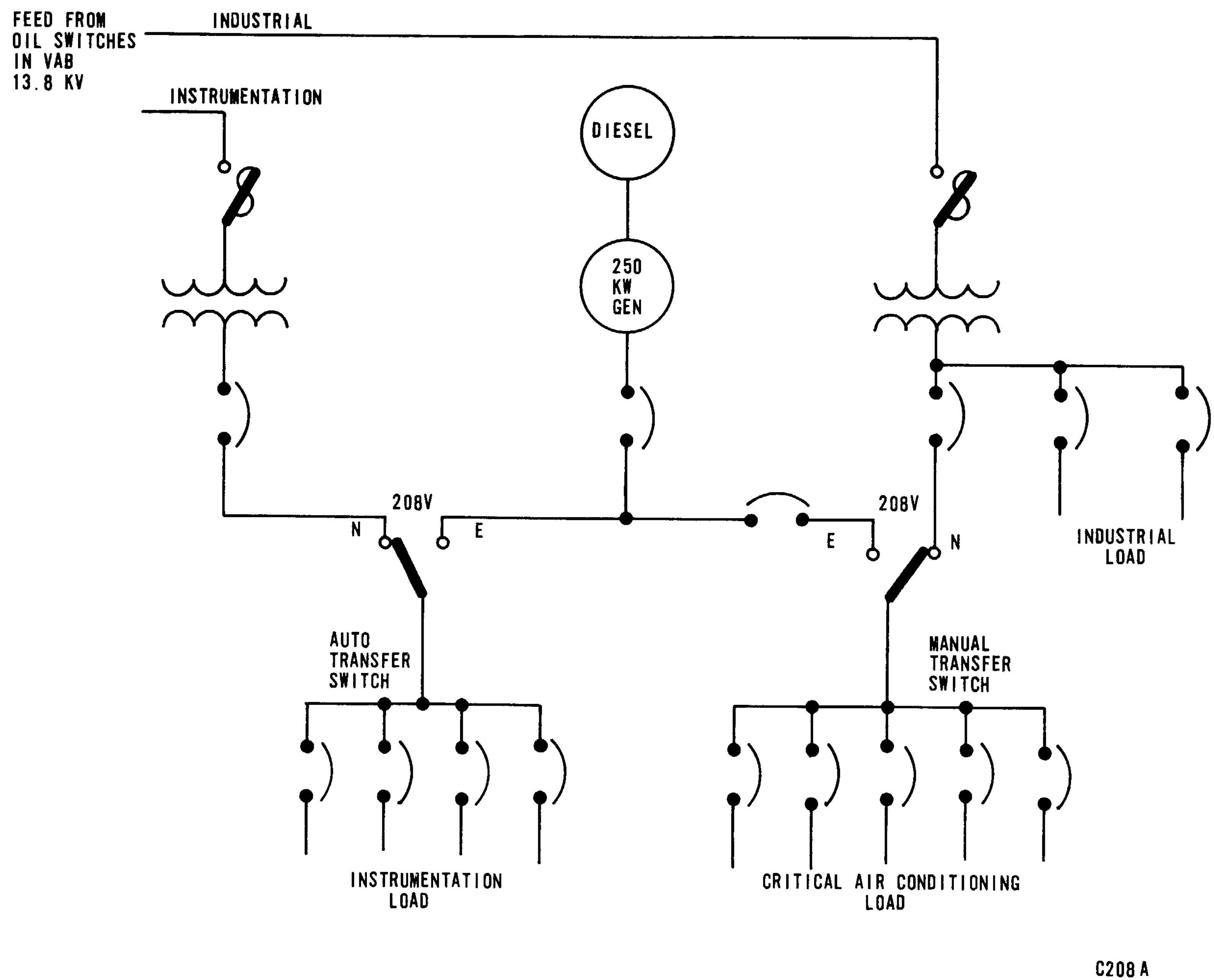


Figure 2-43. Instrumentation Building Power Distribution (Block Diagram)

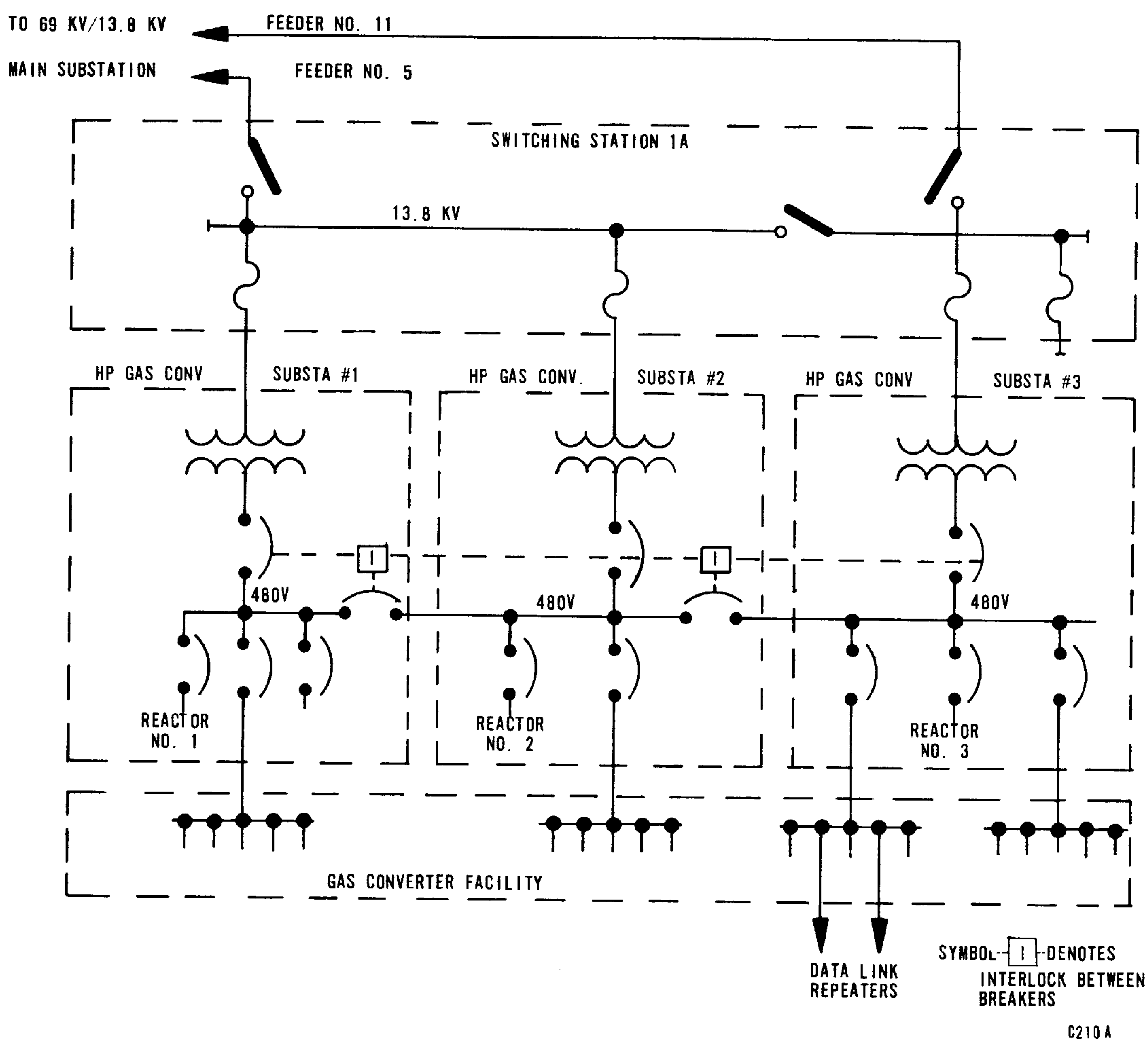


Figure 2-44. Switching Station No. 1A and Converter/Compressor Facility Power Distribution (Block Diagram)

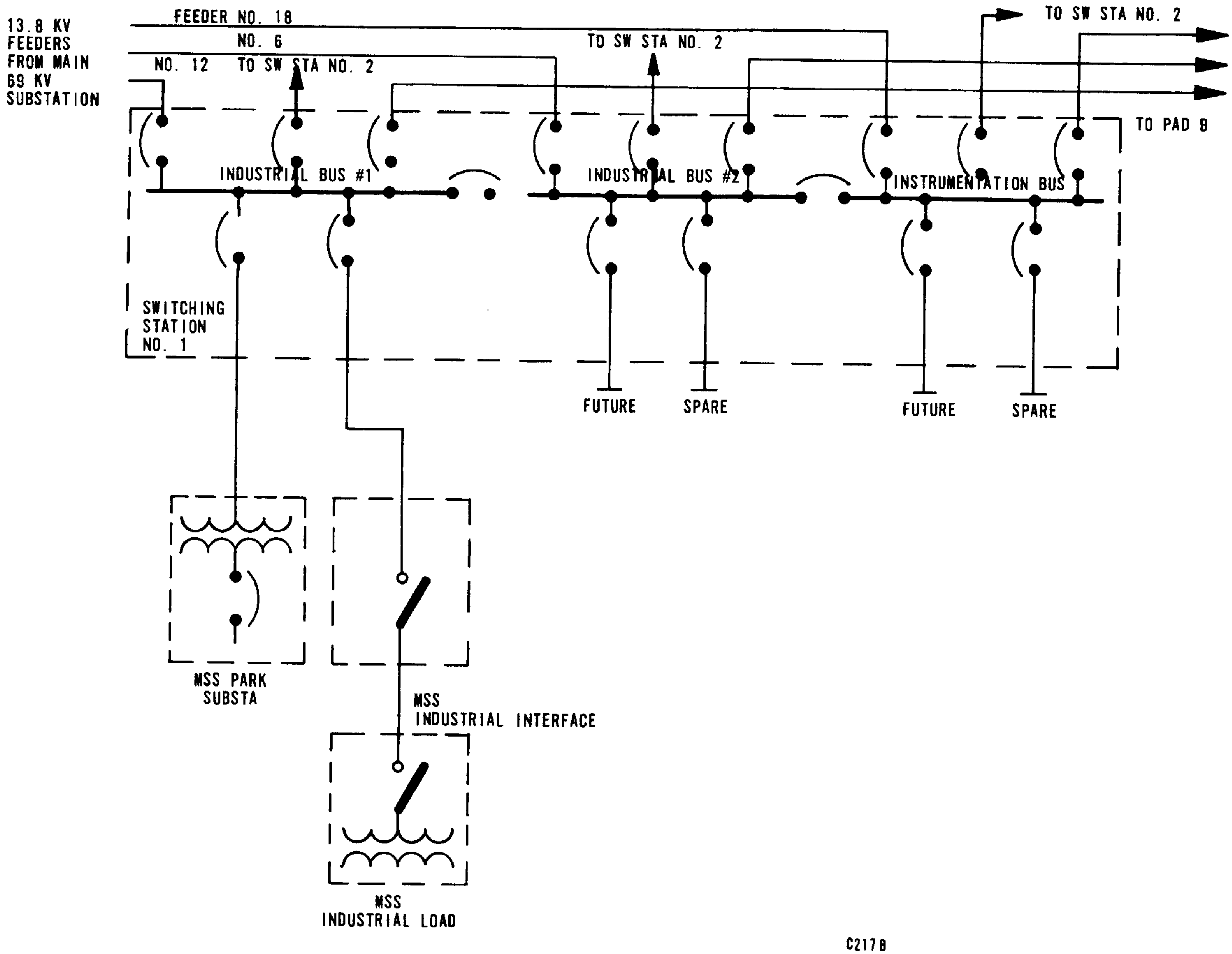


Figure 2-45. Switching Station No. 1 Industrial and Instrumentation Power Distribution (Block Diagram)

feeders continue on to Switching Station No. 2 at Pad A, and also to Switching Station No. 3, at Pad B.

Loads in the MSS park are supplied by a substation which receives three-phase power at 13.8 kv and supplies 480 v to the loads.

Three phase 13.8-kv industrial power is provided by Switching Station No. 1 to the MSS interface unit in the MSS park.

The MSS has its own emergency power generators.

2.11.6.16 Launch Area A. Three-phase 13.8-kv power is supplied from Switching Station No. 1 to Switching Station No. 2 (Figure 2-46), through two feeders No. 6 and No. 12, which distributes power to the various substations in the pad area. Switching Station No. 2 has two industrial power buses and one instrumentation power bus. Each bus can be connected to the adjacent bus in the event of a power failure. The substations in the pad area supply power at 480 v with exception to 4160 v, which is supplied three phase power to the fire water booster pump motors and the LOX pump motors. Substations are located in the pad area as follows:

a. Remote air intake.
b. LOX facility.
c. Main gate.
d. LOX pump.
e. ECS (two substations).
f. RP-1/LH_2 facility.
g. Fire water booster pump.
h. PTCR-industrial.
i. PTCR-instrumentation.

In addition to the pad area substations, Switching Station No. 2 supplies three phase 13.8-kv power directly to:

a. MSS interface - industrial.
b. LUT interface - industrial.
c. LUT interface - instrumentation.

Emergency power (Figure 2-47) on the pad is supplied by two 300-kw, 480-v diesel generators located at Switching Station No. 2.

Upon loss of normal power, the generator is started automatically. An automatic transfer switch supplies emergency power to critical circuits in the area, including two circuits to the LUT interface. Automatic transfer switches on the LUT transfer the critical loads to the emergency power system. Also, critical loads in the pad area include emergency lighting and fire alarms and sump pumps.

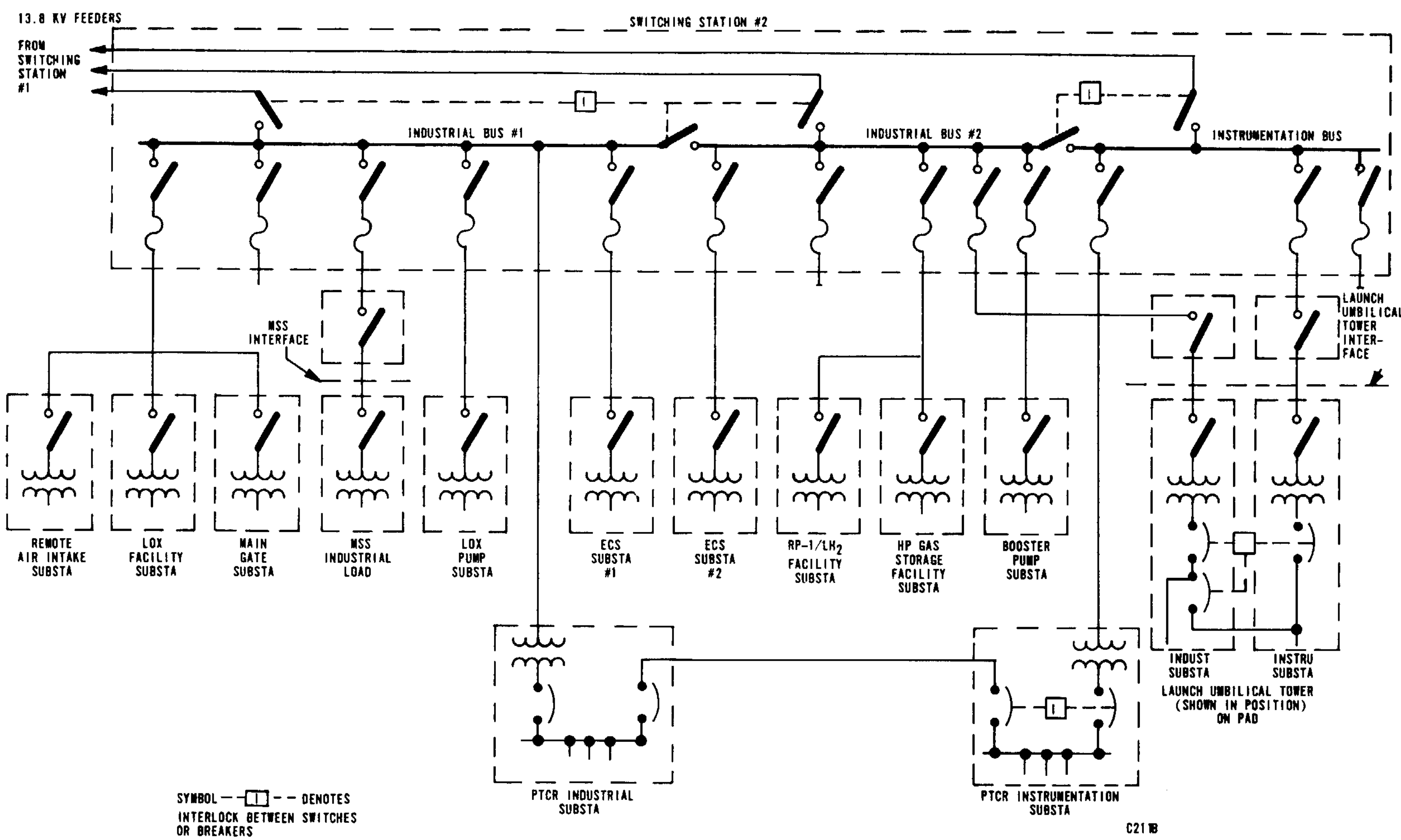


Figure 2-46. Switching Station No. 2 and Launch Area Industrial and Instrumentation Power Distribution (Block Diagram)

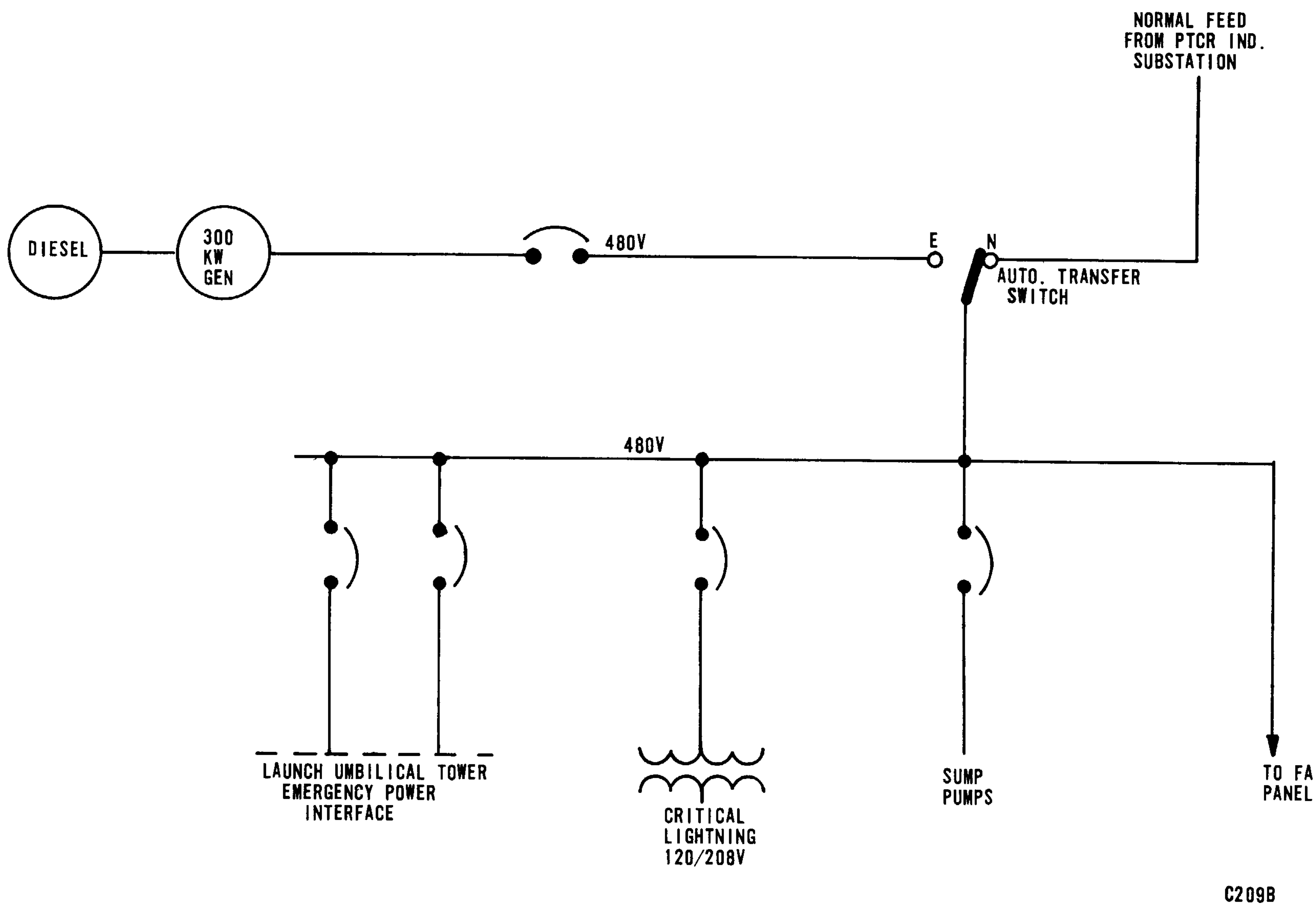


Figure 2-47. Launch Area A Emergency Power Distribution (Block Diagram)

2.11.6.17 Pad Water Pumping Station. The Pad Water Pumping Station is located on the Crawlerway between Pad A and Pad B. It is supplied three-phase 13.8-kv power from the industrial bus of Switching Station No. 3. A substation at the pumping station provides 480-v power.

No emergency power is supplied to the Pad Water Pumping Station.

2.11.6.18 Launch Umbilical Tower. Three phase industrial and instrumentation power at 13.8 kv is supplied to the LUT (Figure 2-48) from interfaces at the VAB and the launch pad. Industrial power and instrumentation power are supplied through separate substations; however, instrumentation loads can be fed off the industrial substation should the normal supply be lost. The substations supply 480-v power to loads.

The LUT emergency power circuits supply power for critical lighting, critical air-conditioning, an elevator, and essential vehicle support. Emergency power at 480 v is available to the LUT during transit and at the pad. Emergency power is not available at the VAB.

A manual transfer switch on the LUT provides for connection of the emergency circuits to either the Pad Emergency Power Interface or the In-Transit Crawler Power Interface. At the pad, emergency power is supplied from the diesel generator in the PTCR. Automatic transfer switches in the LUT switch critical loads to the emergency supply in the event normal power is lost. In transit, power is available to the emergency circuits only. This power is supplied from diesel generators aboard the Crawler/Transporter.

2.11.6.19 Mobile Service Structure. Three-phase 13.8-kv industiral power is fed to the MSS (Figure 2-49) from interface units located in the MSS park area and at the pad. A substation located in the MSS provides 480 v to loads.

In transit, power is available to the emergency system only. This power is supplied from diesel generators aboard the Crawler/Transporter. Manual transfer switches are provided to switch from normal power to in-transit Crawler/Transporter power.

Onboard emergency power is available to the MSS at all times. Two 150-kw, 480-v, emergency diesel generators, located on the MSS, supply critical loads during loss of power from either the unit substation or the Crawler/Transporter. The generators are automatically started and are connected to the critical loads by an automatic transfer switch. One generator supplies power to elevator No. 2. The other generator supplies power to critical lighting, hoists, and hydraulic systems.

2.11.6.20 Universal Camera Sites. The power provided to the sites is 13.2-kv. The unit substations are rated for 37.5-kva, 3-phase, 4-wire, 13.2-kv 120/208-v. The UCS power box is rated at 30-kva, 120/208-v, 3-phase, 4-wire. The power box is mounted on a concrete pedestal near the universal pad, and has a weather-proof circuit breaker panel mounted behind it. The panel contains individual branch circuit breakers for each of the three Mobile Anetheodolite Camera (MCC) target lights and shield covers.

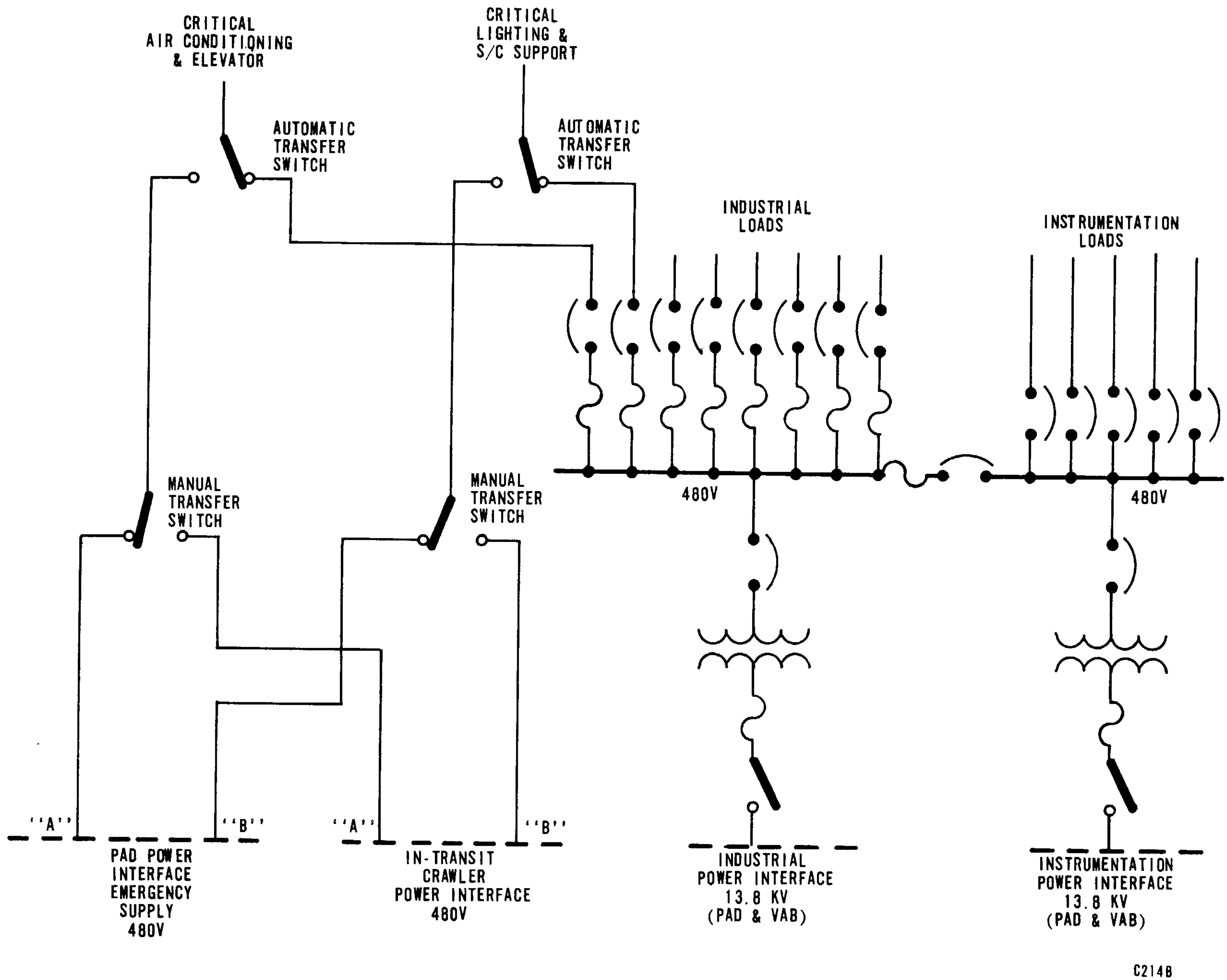


Figure 2-48. Launch Umbilical Tower Power Distribution (Block Diagram)

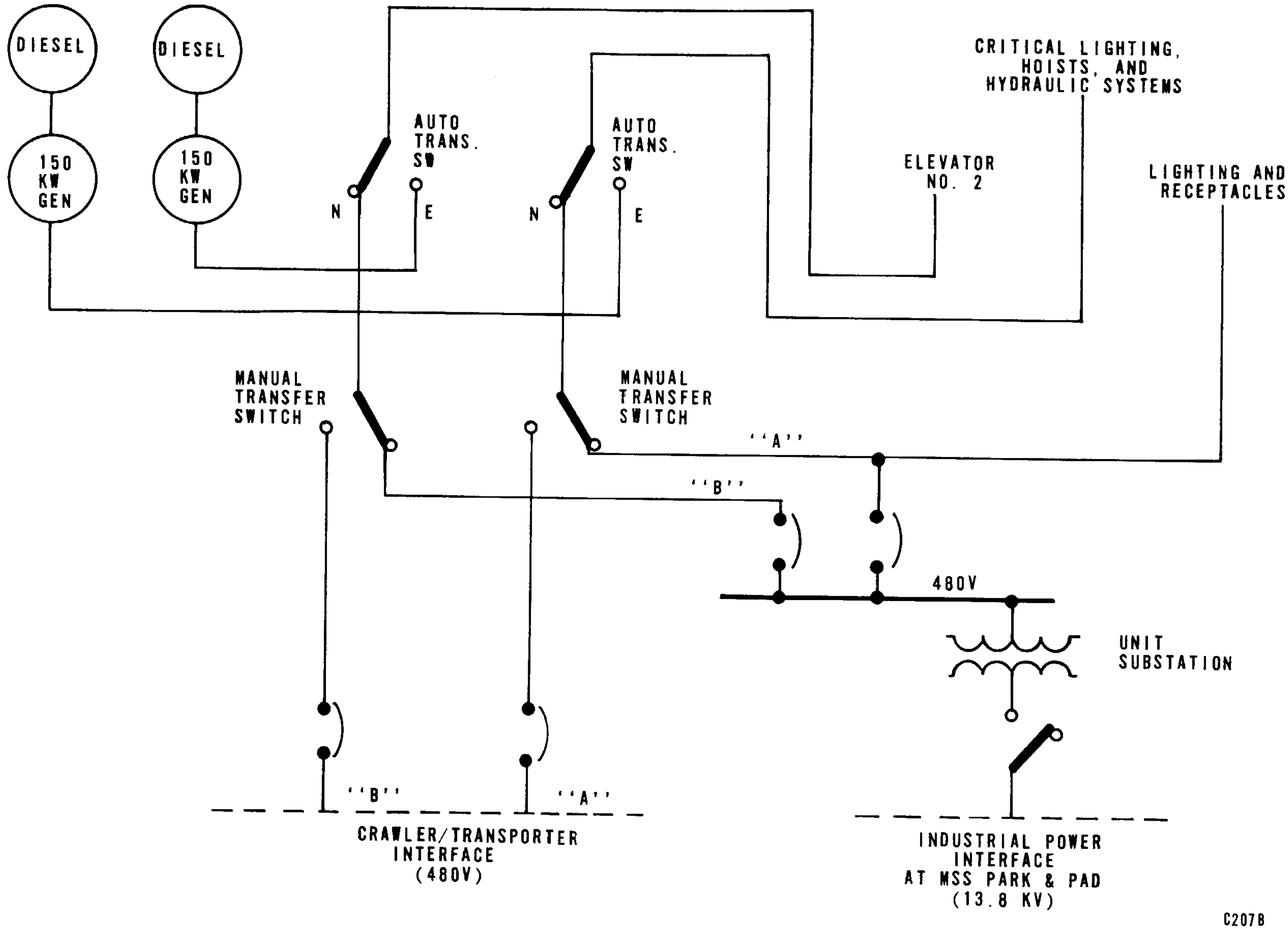


Figure 2-49. Mobile Service Structure Power Distribution (Block Diagram)

The individual circuit breakers are sized for a 150-watt lamp in each target, and a maximum of 4 amps, 120 volt, single phase power for each shield cover motor.

2.11.7 PHOTOGRAPHY. The LC-39 photography system provides space vehicle documentary and engineering instrumentation film.

This system contains more than 130 motion picture cameras. Generally, the cameras are operated by remote automatic or manual control. Camera locations include the LUT, launch pad, six pad perimeter sites, and 18 universal camera sites.

Three of the pad perimeter sites have tracking camera units. However, the majority of the cameras have a fixed optical axis.

A camera control console and three tracking consoles are located in the LCC. Control, distribution, and patch panels are located in the LUT and the PTCR.

The total system camera coverage includes:

a. Prelaunch.
b. Launch.
c. Flight up to 1300 feet.
d. Several possible deviations from a normal flight.

2.11.7.1 Camera Description. The system's cameras include conventional and special cameras in the 16mm, 35mm, and 70mm frame sizes. Special cameras have unique features such as: multiple frame rates, high speed shutters, etc. All cameras have timing marks registered to one side of the film frame. Focusing will be prefixed on the subject matter. Automatic exposure control is also provided for each camera.

Fixed and tracking cameras will be moved to support the active launch pad within the launch complex. The actual camera quantity, type, and coverage will vary with the mission requirements:

The following is a partial list of typical fixed camera coverage:

a. Holddown Arm.
b. Tail Service Mast.
c. Flame Bucket.
d. Propellant Loading.
e. Command Module.
f. Spacecraft.
g. Documentary.
h. Surveillance.

A group of pad perimeter fixed cameras are used for overall vehicle surveillance. Commencing at T-17 hours, these cameras will photograph the space vehicle and environment at a one frame per second rate.

Tracking cameras primarily provide camera coverage of the space vehicle in flight. A tracking camera unit consists of a transportable tracking mount, television camera, and four or more film cameras. The television camera (part of the OTV) is connected to a tracking console in the LCC. The console operator will view his TV monitor, and with a joystick control, position the tracking mount. A tracking camera unit, console, and operator are required for each of the three launch perimeter tracking sites.

2.11.7.2 Camera Control. Two groups of cameras are used in this system. One group is operated solely by manual control and another group is operated either manually and/or automatically.

The manually controlled (ON/OFF) cameras may be operated during any portion(s) of a countdown from the camera control console; for example, the vehicle surveillance cameras.

The manual/automatic controlled cameras have specified conditions for operation. The camera control console will only be able to turn the cameras ON/OFF prior to T-186 seconds. After T-186 seconds, control is released to the launch vehicle sequencer and cameras will be turned on at a prescribed sequencer time. However, the camera control console has a master turn-off control. Master camera turn-off may also be initiated by the launch vehicle sequencer.

Manual/automatic cameras are furthermore divided into 20 camera channels. These channels are prepatched in the LUT and PTCR. Prior to T-186 seconds, the camera control console may operate (turn ON/OFF) any camera channel(s), as required.

2.11.7.3 Camera Control Console. The camera control console located in the LCC is the camera system hub. This console contains:

a. Camera status lights.
b. Camera control switches.
c. Frame rate switching.

Status of each camera is displayed by GO-NO/GO, and RUNNING indicators. To indicate a GO condition, the camera must have power, timing, sufficient film for the mission, and shutter/frame rate/light level confidence.

Frame rates for the variable rate cameras are selected from the console. This portion of the system activates a tone generator which, in turn, determines the camera frame rate. The variable rate cameras are divided into ten channels. Each camera channel may be operated on one out of a possible 20 frame rates.

2.11.7.4 Universal Camera Sites. Eighteen universal camera sites will provide support to cameras used for photographic documentation of the Apollo/Saturn V space vehicle launch and flight. With the exception of universal camera site No. 6, all sights are operational.

The universal camera sites support a ballistic camera and any one of the three following camera types:

a. Mobile Cinetheodolite Camera (MCC).
b. Mobile Optical Tracker (MOT).
c. Intermediate Focal Length Optical Tracker (IFLOT).

The hard stands of the universal camera sites are 20 feet by 50 feet, reinforced concrete pads capable of supporting wheel loads of 10,000 pounds. One side of the pad has the capability of securing a MCC, MOT, or IFLOT; the other side, a ballistic camera.

The ballistic "T" pad (Figure 2-50) is isolated from the rest of the pad with one-inch isolating material. This provides isolation and drainage for the "T" pad from the rest of the universal pad. The ballistic camera is mounted on six "T" slots equally spaced at 60 degrees around the survey marker near the center of the "T" pad.

The MCC pads consist of concrete guides located so that a survey marker is at the center of the camera location at all times. These concrete guides also provide for stabilizing and isolating the cameras from all outside interference. This is done by lifting the camera off the camera transporter bed with screw jacks secured to the camera mount and to concrete guides. Three concrete foundations are provided for the support of the MCC collimator lens assemblies. These foundations are located approximately 17 feet from the MCC survey marker and with approximately 120 degrees between each foundation. Similar provisions, except the foundations, are provided to support the target shield assemblies. The foundations for the collimator lens shields and for the target shields assemblies will maintain the shields in the vertical position without permanent deflection, in winds of 125 miles per hour.

The equipment provided on each of the universal camera sites is a unit substation, a circuit breaker, a Universal Camera Control System (UCCS), a power box, a UCCS communication box, and a communication terminal cabinet.

A weatherproof communication terminal cabinet, mounted on a concrete pedestal near the pad, has three 4-inch conduits used for cable access to the pad communications system from the main arterial communications system. Cables are connected from the terminal box to the UCCS communication box, which provide the communications throughout the universal camera site.

Cameras on Sites 3, 4, 7, 8, 12, and 15 can be operated by remote control.

A paved area is provided to and near the universal camera sites (Figure 2-51) for access and parking.

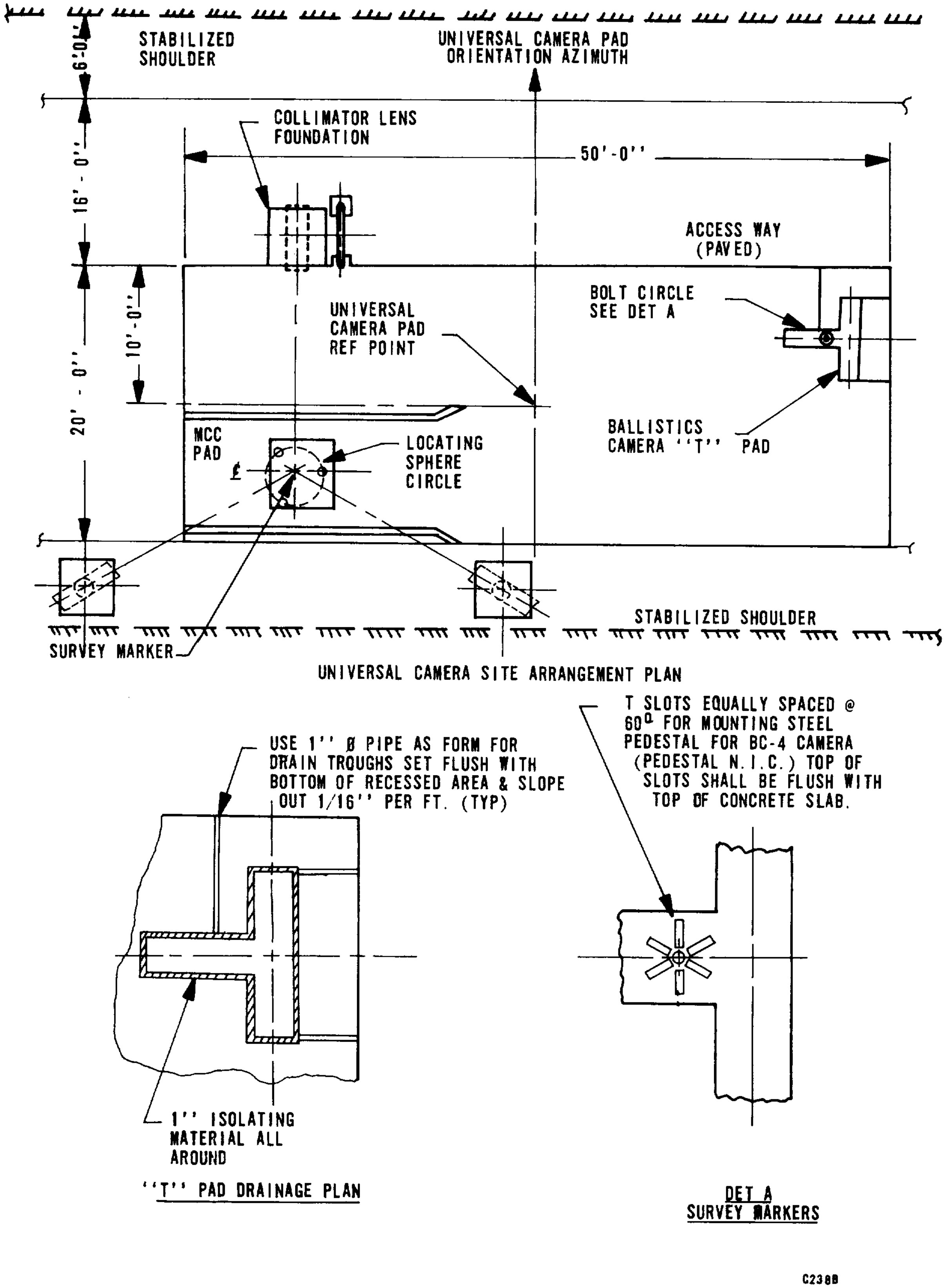


Figure 2-50. Universal Camera Pad

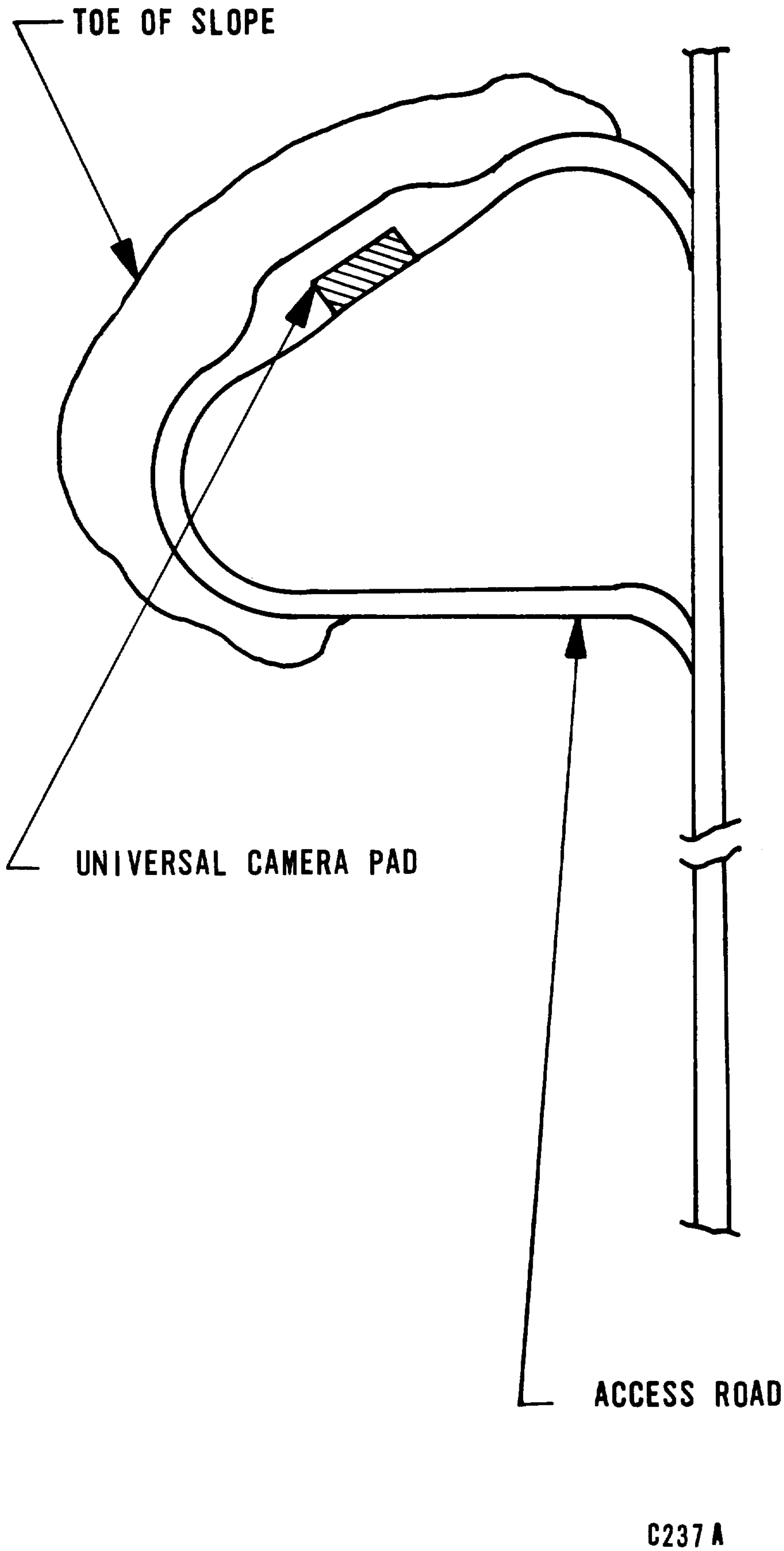


Figure 2-51. Typical Universal Camera Site

2.11.8 FIRE ALARM AND PROTECTION SYSTEM. The Fire Alarm and Protection System notifies personnel of the existence and location of fires, and in certain areas, automatically initiates protective devices such as sprinkler, flooding, and foam systems.

The Fire Alarm and Protection System is composed of one central system loop, with subsystems located in the Utility Annex and on the pads. The Utility Annex subsystem provides loops for the VAB and facilities in the VAB area. The pad subsystems feed radially to various facilities in the pad area. The central loop connects all KSC facilities; however, location of fires within the Utility Annex and pad subsystems cannot be pinpointed to specific locations within the subsystem.

Fire Alarm and Protection System equipment includes manual noncoded fire alarm boxes, automatic fire detectors, alarm gongs and horns, coded transmitters which provide location information on looped systems, control panels, and auxiliary protective system contacts. These devices are interconnected by signal circuits to complete the system.

Fire Alarm and Protection System (Figure 2-52) displays are located in the CCC and the KSC Central Fire Station. Local subsystem displays are located in the Utility Annex and pad areas.

2.11.8.1 VAB. Loop circuits are provided to the various VAB areas, and tie into the fire alarm headquarters in the Utility Annex. These loop circuits connect coded transmitters in specific locations. These coded transmitters are actuated by manual alarm boxes, fire detectors, and sprinkler valves. Each transmitter is connected to a control panel which provides control functions on the loop and provides for alarm actuation. Loop circuits are also provided to the LUT interfaces.

2.11.8.2 Utility Annex. The Utility Annex has one loop circuit, similar to those in the VAB. The fire alarm headquarters for the VAB is located in the Utility Annex. Any fire alarm in this subsystem will be transmitted to the central system loop; however, the central loop system will not have the ability to pinpoint the location of the fire within the subsystem.

2.11.8.3 Other Utility Annex Subsystem Facilities. Loops from the Utility Annex, similar to those described, are provided to the LCC, Paint and Storage Area, and Sewage Treatment Plant. Two spare circuits are provided.

2.11.8.4 Central Loop Facilities. The following facilities have coded transmitters tied into the central loop. Each facility has alarm and detection devices as necessary for its protection. Those facilities include:

a. 69-kv substation.
b. Industrial water pumping station.
c. MSS park.
d. High-Pressure Gas Converter/Compressor Facility.

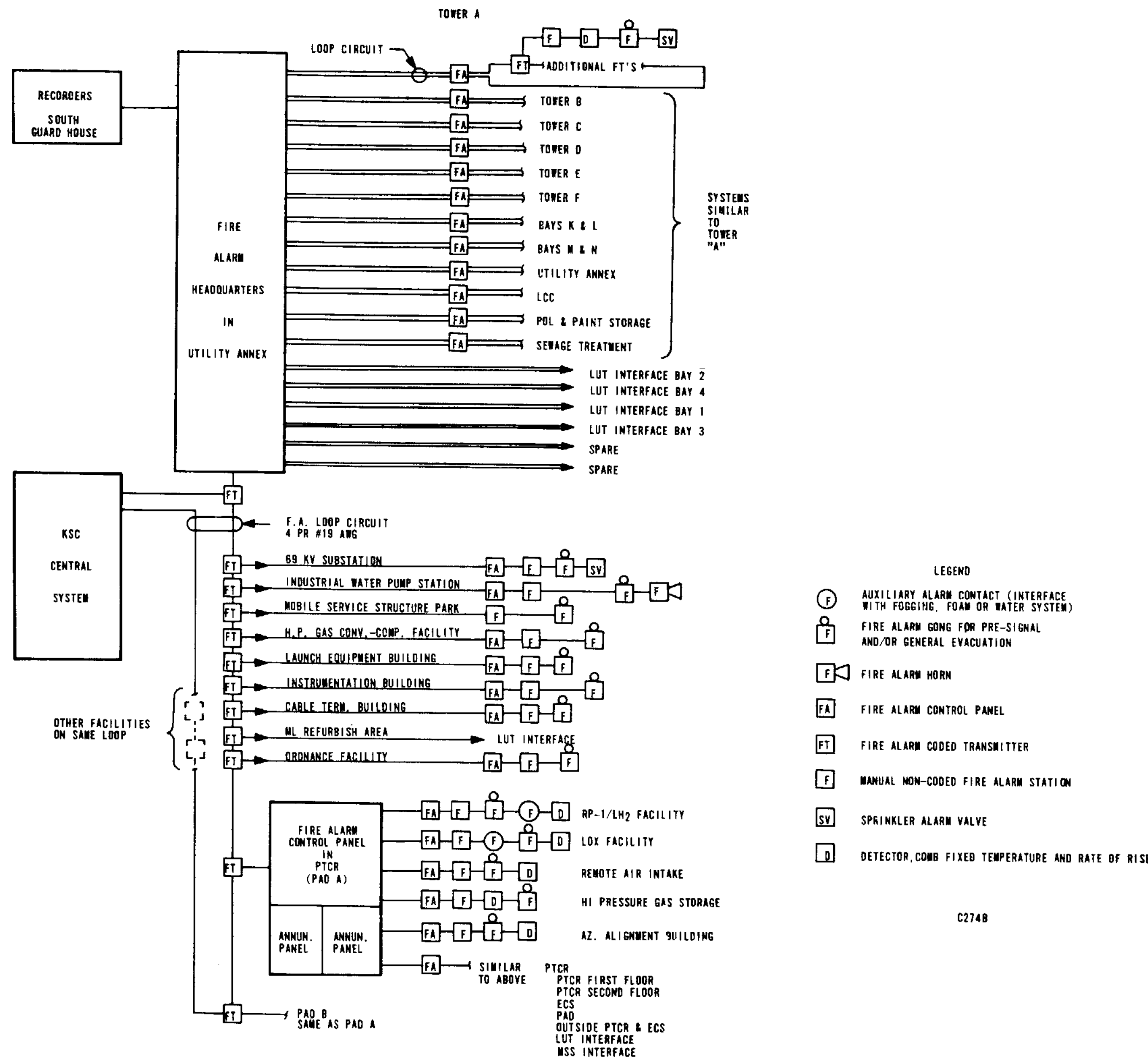


Figure 2-52. Launch Complex 39, Fire Alarm System (Block Diagram)

e. Launch Equipment Building.
f. Instrumentation Building.
g. Cable Termination Building.
h. LUT refurbishment area.
i. Ordnance Storage Facility.
j. Other facilities may be added to this loop as required.

Alarms on the central loop are displayed in the KSC Central Fire Station and the monitor station in the CCC.

2.11.8.5 Launch Pads. The launch pads have subsystems tied into the central loop in a manner similar to the subsystem in the Utility Annex. The subsystems for Pad A and Pad B are identical, and only one will be described.

The pad subsystem is a radial system which terminates in the control panel in the PTCR. A display panel in the PTCR provides alarm indications for the various facilities in the pad area. Each facility has detection and alarm devices as necessary for its protection. These facilities include:

a. RP-1/LH_2 facility.
b. LOX facility.
c. Remote air intake.
d. High-Pressure Gas Storage Building.
e. Azimuth Alignment Building.
f. PTCR, ECS, Pad, etc.
g. MSS interface.
h. LUT interface.

As in the Utility Annex subsystem, alarms from the pad subsystem are picked up on the central loop; however, the central loop system will not be able to pinpoint the location of the fire within the pad subsystem.

2.11.8.6 Launch Umbilical Tower. The LUT has its own self-sustaining fire alarm system. It is composed of automatic detectors, manual alarm boxes, alarm sounding devices, and sprinkler valve monitors. Interface connections are provided at the VAB, refurbishment area, and pad for connection to area systems.

2.11.8.7 Mobile Service Structure. The fire alarm system on the MSS is similar to that on the LUT. Interfaces to area systems are provided at the pad and the MSS park.

2.11.9 AREA WARNING SYSTEM. The Area Warning System provides warning to personnel within a hazardous area and controls access to that area. The system consists of safety signals that control access to the Crawlerway and Pad A.

2.11.9.1 Launch Pad. There are 10 safety signals located on the launch pad. Two of these are located on the stairs at the west edge of the raised portion of the pad. The other eight are traffic signal type installations on stanchions and are located on the roads about the pad. They control access to the pad, fuel facilities, and launcher area. Control of all pad signals is from the PTCR safety signal panel, while the lights at the fuel facilities have local controls also. The signals all show four indications and are provided with interpretive signs stating:

a. Red - Danger! Clear Area.
b. Flashing Amber - Hazardous! Do not enter.
c. Amber - Enter with caution.
d. Green - All clear.

2.11.9.2 Crawlerway. There are four lights for the safety signal system located on the Crawlerway to display the same indications and interpretations as those on the pad. Three of the lights are mounted at the VAB Crawlerway criteria limits; one light is identified for each of the Pads (A, B, or C) and warns personnel as they leave the VAB limits. The one remaining signal is on the Crawlerway at the MSS park area and controls access to the pad from the park area. Control of all of the Crawlerway signals is from the safety signal panel in the LCC.

2.11.9.3 CCC Control Concept. The area warning system will include operation of visual and audio warning for the entire complex, with monitor/control centralized in the CCC. Monitoring of signal conditions is necessary to assure that the affected areas are being warned.

2.11.10 WATER SYSTEM. The LC-39 Water System (Figure 2-53) supplies water for fire protection, domestic use, equipment cooling and launch quench, and fogging. The system consists of a water system, a potable water system, a pad fire water system, and a pad industrial water system.

The pad industrial water system and the fire water system are described in paragraph 2.3.4.6.

The potable water system and the fire water system (Figure 2-54) are supplied from a 24-inch main, located along Kennedy Parkway. The main is fed by the city of Cocoa. This main also supplies the KSC Industrial Area and the AFETR. This main is capable of supplying the LC-39 water system with 1,500,000 gallons of water per day at a pressure of 64 psi. There are two connections from the 24-inch main to the LC-39 area. One is a 16-inch main which is normally open and serves as the normal supply. The other connection is a 24-inch line which is normally closed. The 24-inch line is opened only in the event that water is to supplied from the LC-39 area storage to KSC.

2.11.10.1 Storage. There are two water storage facilities located in the VAB area. One is an overhead tank with a capacity of 250,000 gallons. This tank is fed through a check valve and an altitude valve from the 16-inch main. The water level in the tank is maintained by the supply-main pressure. This tank supplies water to the potable booster pumps located in the Utility Annex and to the distribution lines serving the VAB area, CCF, MSS park area, and LC-39 pad areas.

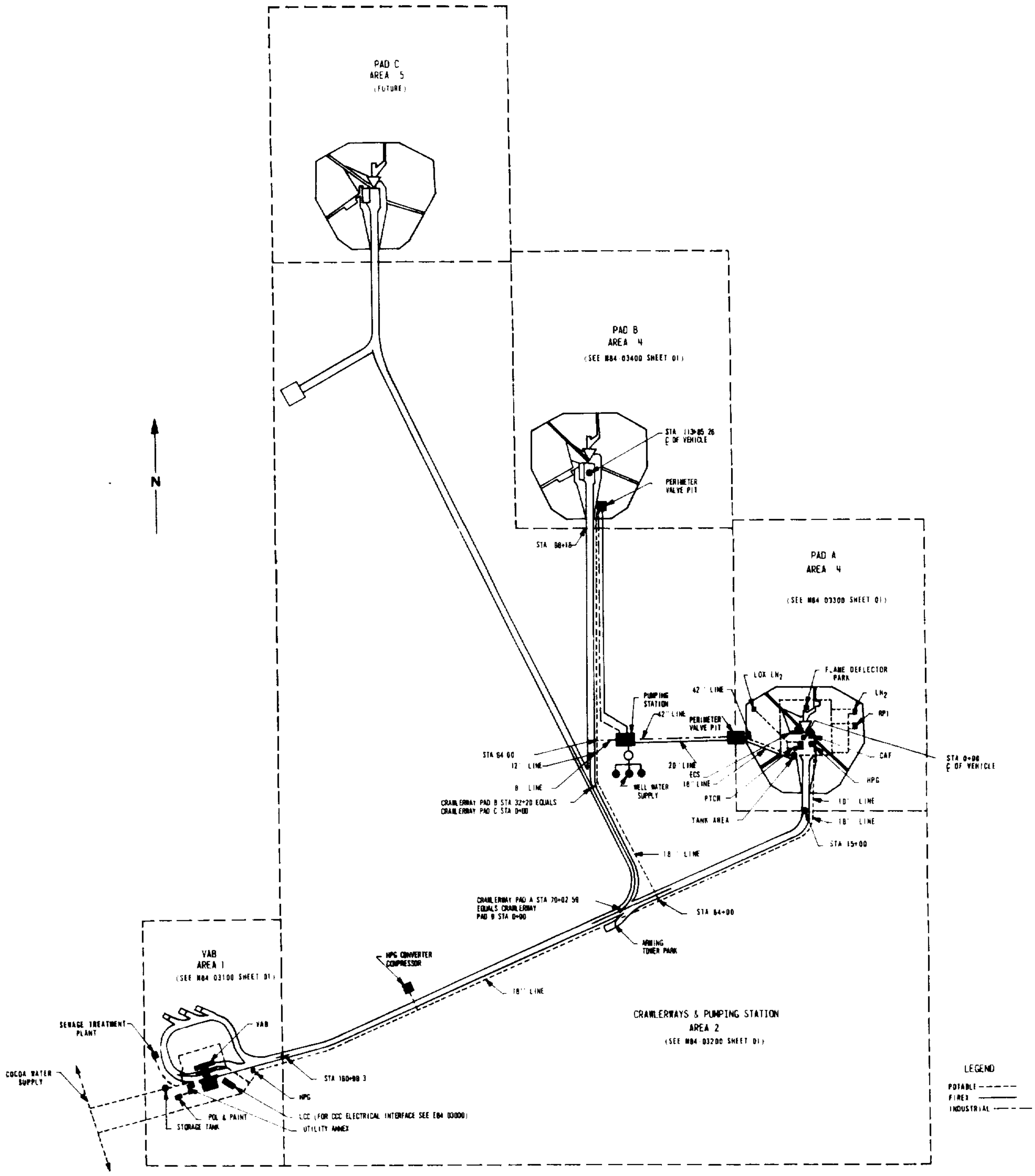


Figure 2-53. Launch Complex 39, Water Distribution

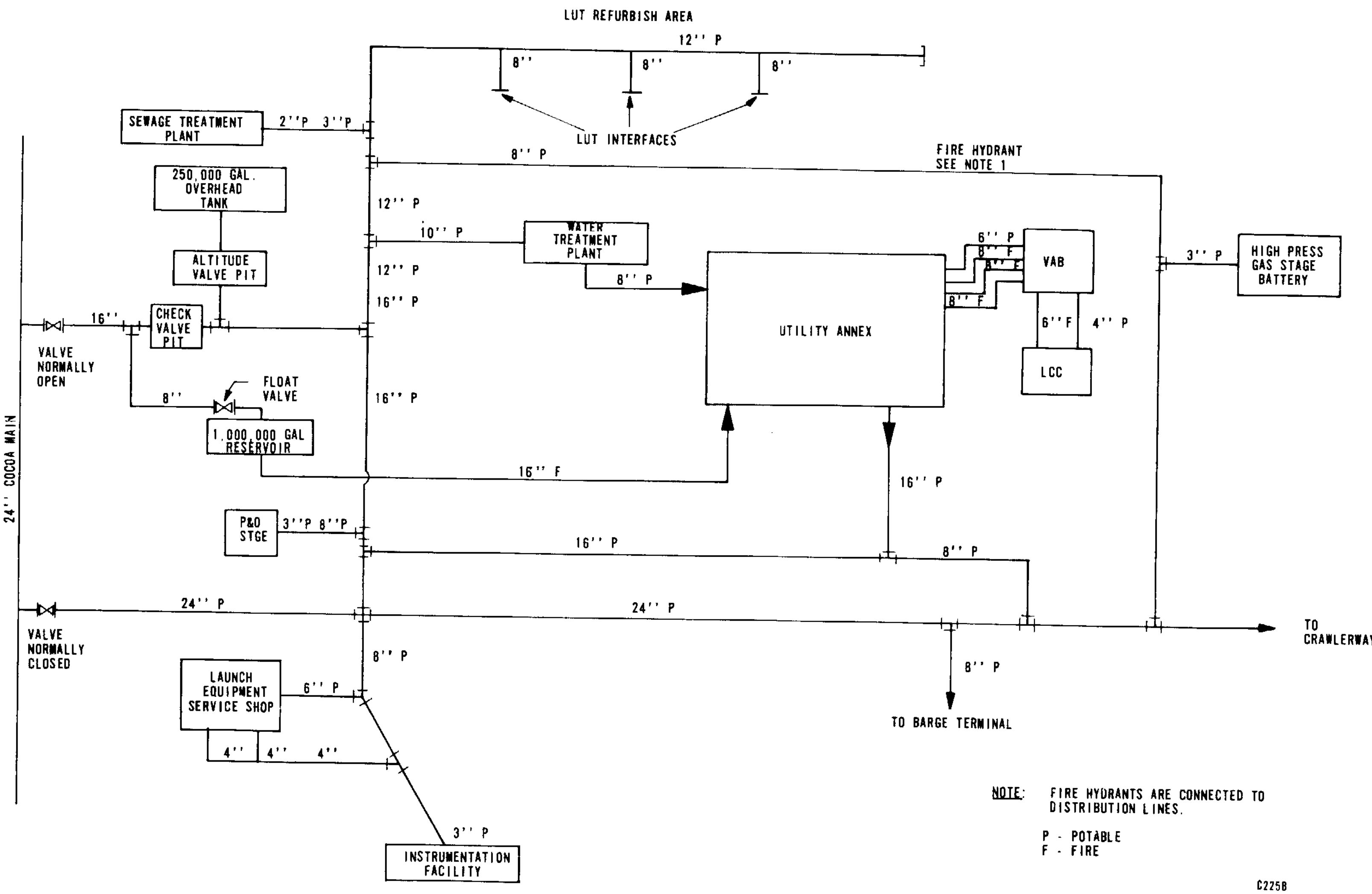


Figure 2-54. Launch Complex 39, Assembly Area Water System

The second storage facility consists of a ground reservoir with a capacity of one million gallons. This reservoir is fed from the 16-inch main through an 8-inch connection. The level is automatically controlled by a level indicator. This reservoir supplies water to the fire booster pumps located in the Utility Annex.

2.11.10.2 Distribution. The overhead storage tank feeds the LC-39 system (Figures 2-26, 2-54, and 2-55) providing a supply loop in the VAB area and a distribution main to the Crawlerway area and the pad area.

2.11.10.3 Water Treatment Plant. The water treatment plant consists of the water softening equipment. The equipment is fed from the VAB area loop through a 10-inch line. After treatment, the water is routed to the Utility Annex through an 8-inch pipe.

The water from the water treatment plant serves the local building use and the domestic pumps.

2.11.10.4 Utility Annex. The Utility Annex (Figure 2-56) houses the following portions of the VAB Water System:

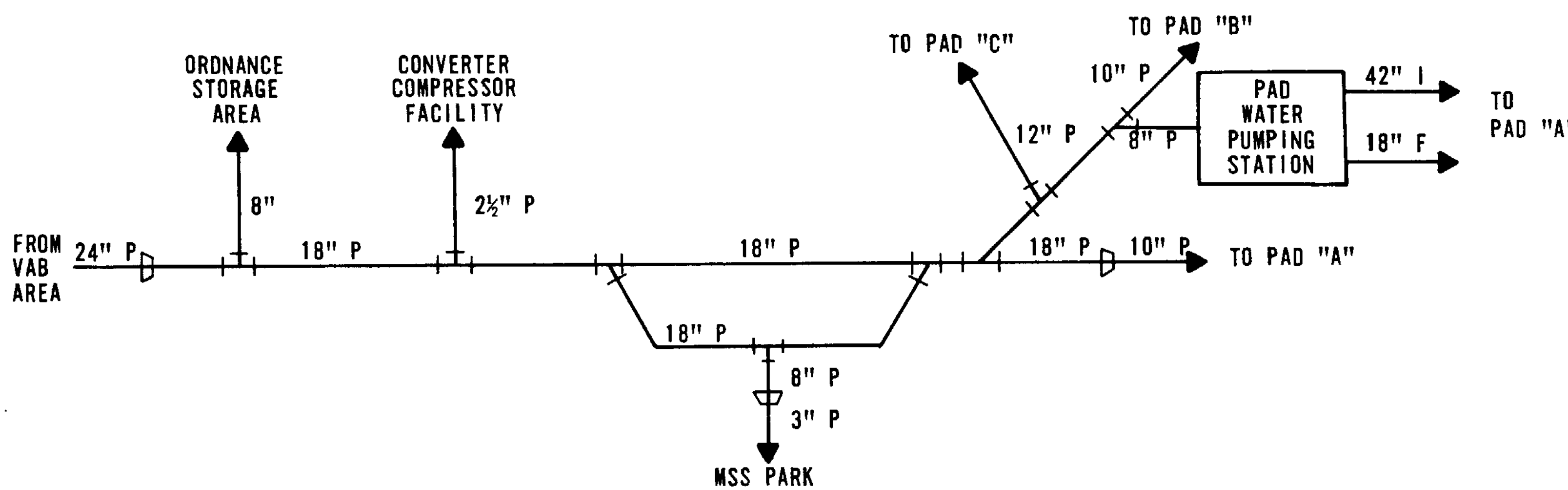
a. Potable booster pumps.
b. Fire booster pumps.
c. Chlorination equipment.
d. Necessary piping, valves and controls.

One line serves the domestic, boiler feed, and cooling water requirements of the Utility Annex. Another line furnishes water to the suction side of the three potable water booster pumps. These pumps are electrically driven and each pump has a capacity of 325 gpm at 265 psig. The 6-inch outlet from these pumps serves the potable water storage tank and the fire water reserve tank on the 40th level of the VAB. These pumps are automatically controlled from the two tanks on the 40th level.

Water from the 1,000,000 gallon ground reservoir feeds the suction side of the three fire water booster pumps in the Utility Annex. The three pumps are diesel engine driven, started by compressed air.

Two of the fire booster pumps have a capacity of 1,500 gpm at 285 psig. The outlet from these pumps furnishes fire water to the hose stations on the roof of the VAB, the high and low zones in the VAB, the LCC, and the Utility Annex. By means of manual valving, water from these pumps may be used to furnish water to the fire reserve tank on the 40th level of the VAB. These pumps are controlled by float valves in the 40th level VAB fire reserve tank. There is also a manual start switch located on the roof of the VAB. The pumps are manually stopped at the engine control panels or by the pump automatic safety devices.

The third fire booster pump has a capacity of 1,000 gpm at 75 psig. All water furnished by this pump is chlorinated. This pump provides water to the VAB area loop.



C223A

Figure 2-55. Launch Complex 39, Crawlerway Water Distribution System

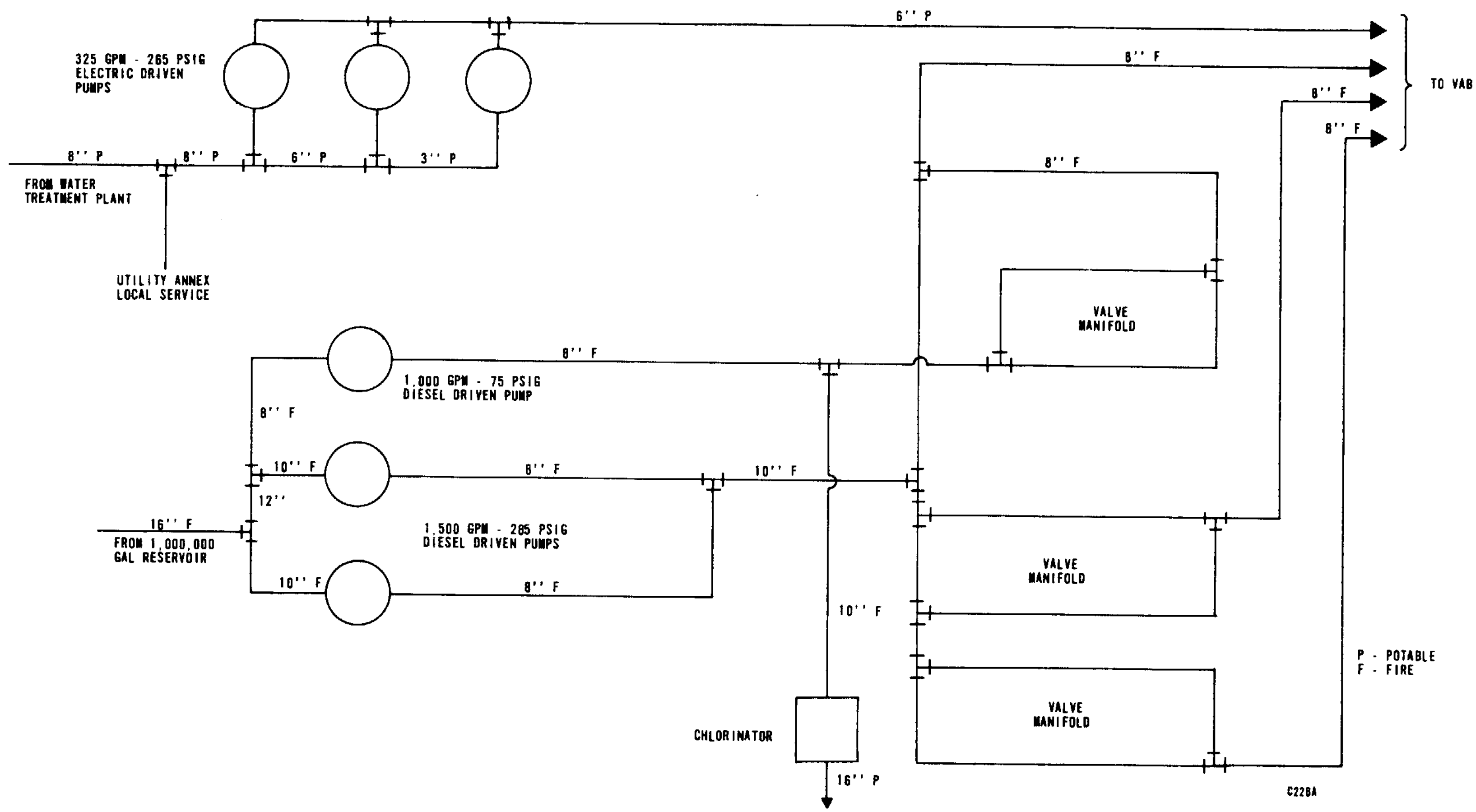


Figure 2-56. Launch Complex 39, Utility Annex Water System

By valving, this pump may furnish water to the outlet side of the 1500-gpm booster pumps. By a second valving arrangement, this pump may furnish water through a 24-inch main, back to the 24-inch main along Kennedy Parkway. This arrangement is used only in the event of an emergency in the Industrial Area. The Utility Annex is protected by sprinklers and hose stations.

2.11.10.5 VAB. There is a potable water system and a fire water system located in the VAB. (Figure 2-57). The potable water system consists of two 10,000-gallon storage tanks, and the necessary piping to furnish water to restrooms, laboratories, drinking fountains, and water-cooled equipment.

One 10,000-gallon storage tank is located on the 40th level and one is located on the 25th level of the VAB. The two tanks are interconnected. Water is supplied to the 40th level tank from the potable water booster pumps located in the Utility Annex. A 3-inch connection is located in each high bay to provide water to the LUT.

The fire water system consists of the two 20,000-gallon fire reserve tanks, a high zone system, a low zone system, and roof hose stations.

One 20,000-gallon tank is located on the 40th level and the other is located on the 25th level. The 40th level tank is maintained at operating level by the potable water booster pumps located in the Utility Annex. This tank may be filled by the 1,500 gpm fire booster pumps. This may be accomplished by manually operating a system of valves. The 40th level tank maintains pressure on the high zone and the 25th level tank. The 25th level tank maintains pressure on the low zone.

In the event of a water flow in the high or low zone, water is supplied from the potable pumps. If these pumps cannot maintain the level in the tank, the 1,500 gpm fire pumps are started consecutively by level sensors in the tank. The 1,500 gpm pumps furnish water directly to the high and low zones.

The high and low zones consist of sprinklers and hose stations. The low zone furnishes water to the LCC.

The VAB roof hose stations are supplied water from the 1,500 gpm fire pumps. A manual start switch is located on the roof.

A 6-inch connection is provided in each high bay to provide fire water to the LUT.

2.11.10.6 LCC. The LCC has a potable water system and a fire water system. The LCC potable water system is supplied from the VAB 10,000 gallon domestic storage tanks through a 4-inch line from VAB Tower D.

2.11.10.7 LUT Erection Area. Water to the LUT erection area is furnished through a 12-inch main from the VAB area loop. This main supplies water to the area hydrants and to the LUT interfaces through 8-inch connections.

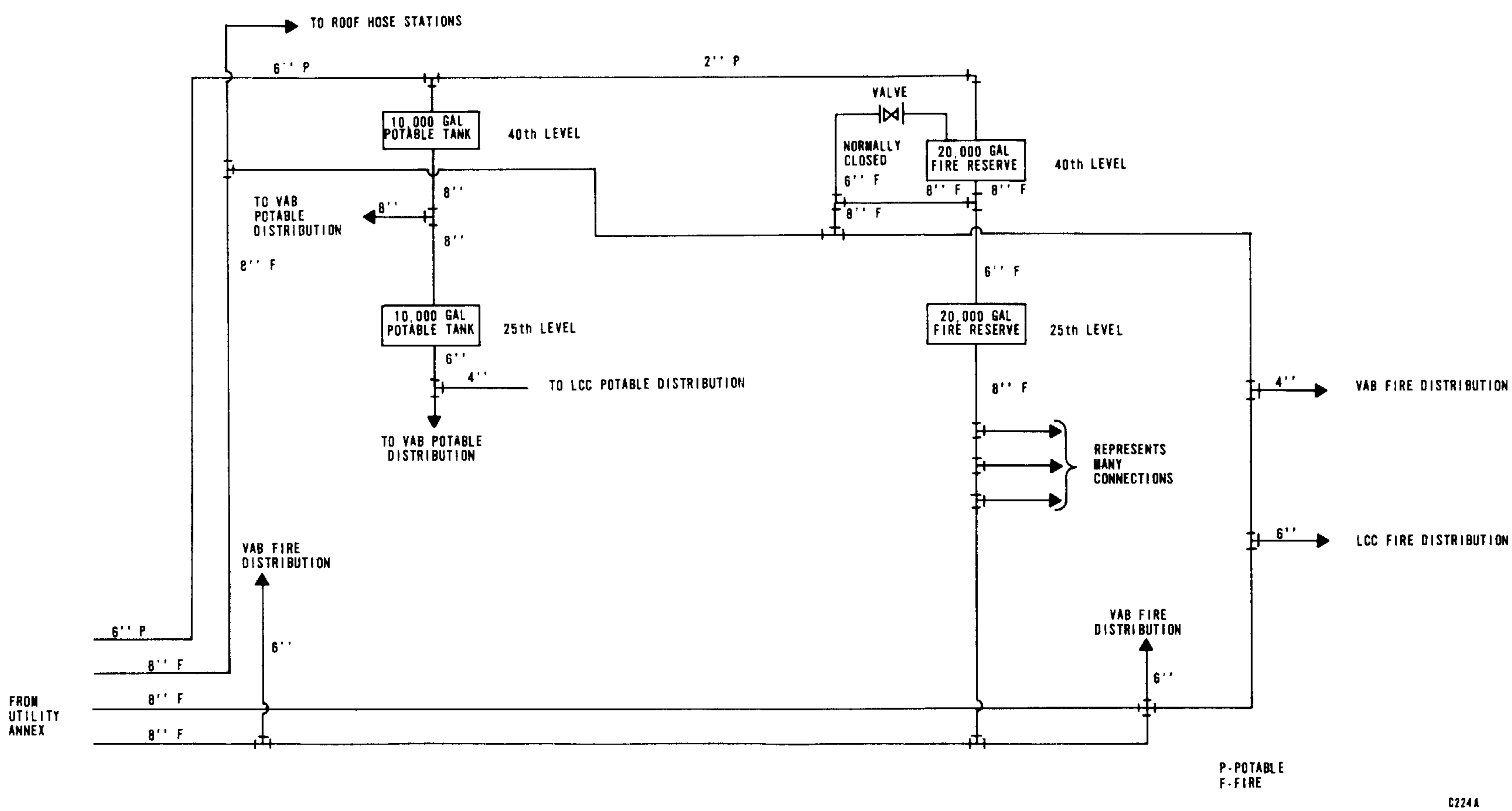


Figure 2-57. Launch Complex 39, Vehcile Assembly Building Water System

2.11.10.8 Paint and Oil Storage. The P&O Storage is furnished water for fire protection only. There are two fire systems in the building. One system furnishes foam and the other consists of sprinklers. Both systems are automatic.

2.11.10.9 Sewage Treatment Plant. Water is furnished to the plant for domestic and process use through a 3-inch connection from the area loop.

2.11.10.10 VAB High-Pressure Gas Storage Battery. The VAB High Pressure Gas Storage Battery is served by a 3-inch connection to the 8-inch potable loop. It is used for wash down and supplies a fire hose rack.

2.11.10.11 Instrumentation Facility. This facility is served by an 8-inch connection to the 24-inch main. The 8-inch connection serves fire hydrants in the area and a 3-inch connection serves the building for domestic purposes and serves a fire hose rack.

2.11.10.12 Launch Equipment Service Shop. This shop is served by a 6-inch connection to the 8-inch main serving the instrumentation facility. This connection serves fire hydrants in the area and a 4-inch connection to this line serves the domestic users. A 4-inch connection to the 8-inch main serves the paint shop sprinklers and the building fire hose racks.

2.11.10.13 Barge Terminal. This facility is served by an 8-inch connection to the 24-inch crawlerway main. This connection serves fire hydrants and a hose connection.

2.11.10.14 Mobile Servicing Structure Park. An 18-inch line is routed into the MSS park area (Figure 2-55). This line is connected at both ends to the Crawlerway main. An 8-inch connection is made to the 18-inch line and is further reduced to a 3-inch line. This line serves the interface furnishing potable water to the MSS for domestic purposes. The pressure in the line at this point will not furnish water above the deck level.

2.11.10.15 Converter/Compressor Facility. Water is furnished to the CCF (Figure 2-56) for domestic purposes only, through a 2.5-inch connection from the Crawlerway main.

2.11.10.16 Pad Pumping Station. Potable water is furnished to the Pad Pumping Station (Figures 2-25 and 2-55) through an 18-inch connection to the Crawlerway main. This water is used for domestic purposes and for engine cooling.

The water passes through a 2,000-gallon storage tank which furnishes suction to a 25 gpm pump. The pump outlet furnishes water to a 90-gallon, hydropneumatic storage tank. This tank then furnishes water to the lavatory facilities and to the engine cooling system.

2.11.10.17 Ordnance Storage Area. This area (Figure 2-55) is served through an 8-inch connection from the 18-inch Crawlerway main. The 8-inch line serves a fire hydrant near the receiving building. A 2-inch connection to the 8-inch line serves the receiving building for domestic purposes.

2.11.10.18 Launch Pad Area. The potable water enters the pad area (Figure 2-26) through a 10-inch main from the 18-inch Crawlerway main. The potable water system furnishes domestic or fire water to the following:

a. LUT.
b. MSS.
c. RP-1 Storage Facility restroom.
d. LH_2 storage facility restrooms.
e. LOX storage facility restroom and pump cooling.
f. Compressed air cooling tower.
g. PTCR restroom and fire hoses.
h. ECS building restroom.
i. ECS cooling tower.

2.11.10.19 LUT Potable Water. This water is supplied from the 10-inch line, in the launch pad valve and tank area, through a 3-inch connection. The water passes through a 150 gpm - 250 psig pump and then into a 4,500 gallon/246 psig hydro-pneumatic tank. The tank is pressurized with gaseous nitrogen. A 3-inch line connects the LUT at the LUT interface.

Potable water is used for toilets on level "A", electric water coolers on levels "A" and "B", and for drinking fountains, emergency eye washes, and emergency showers on levels 30 through 220.

2.11.10.20 Mobile Service Structure. The MSS is served potable water through a 3-inch connection from the valve and tank pit (Figure 2-26) at the pad and through a 3-inch connection at the MSS park. Potable water serves a restroom on the base platform and emergency eye washes, emergency safety showers, and drinking fountains serving platforms 3, 4, and 4a.

2.11.11 COMPRESSED AIR SYSTEM. The LC-39 compressed air system supplies air for the operation of pneumatic operated valves, shop equipment, purging, air-start of diesel engines, cleaning and drying, and for soot blowing. Compressed air is provided from the following locations:

a. Compressed Air Building (launch pad) and PTC (launch pad).
b. Mobile Service Structure.
c. Pad Water Pump Station.
d. Utility Annex (furnished air to VAB, Utility Annex, and LCC).
e. RP-1 foam generator at the RP-1 Storage Area.

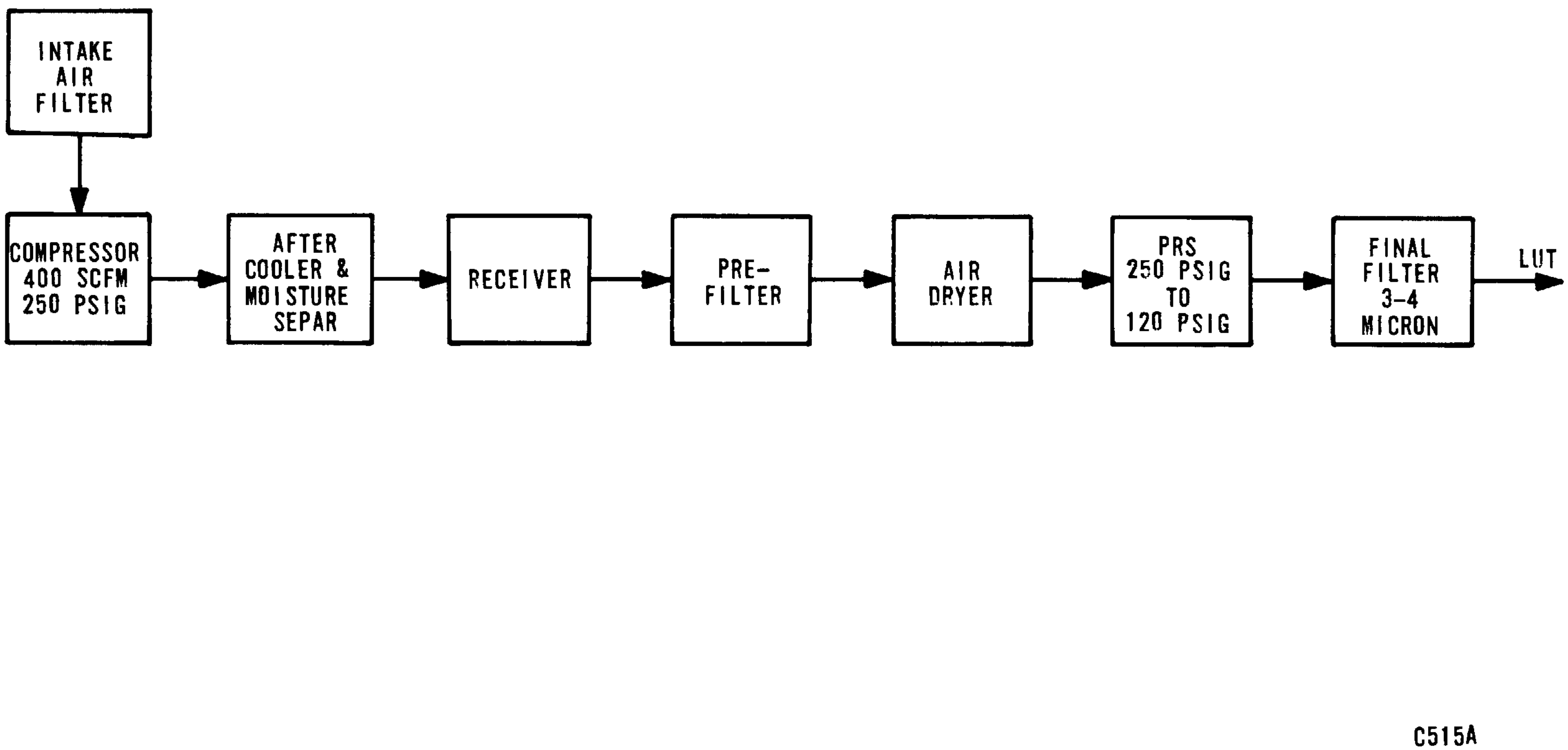


Figure 2-58. Launch Pad Compressed Air System

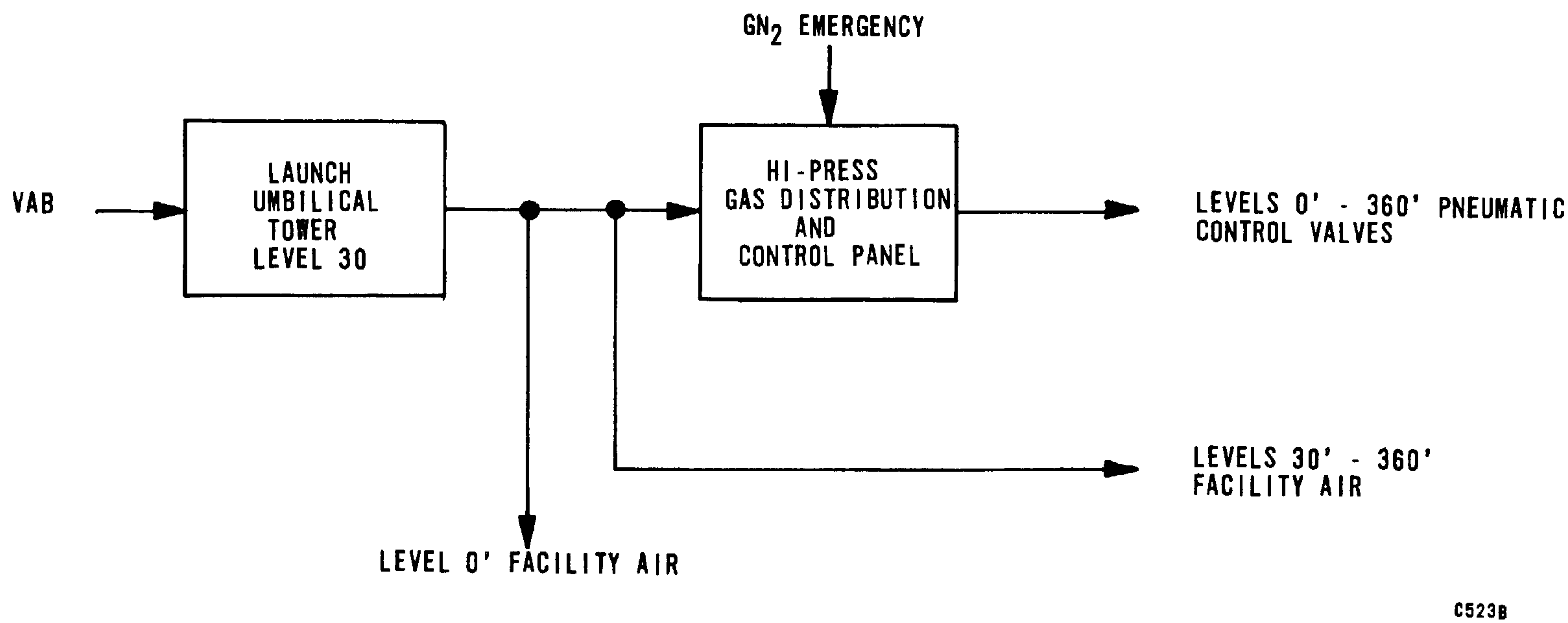


Figure 2-59. Launch Umbilical Tower Compressed Air System

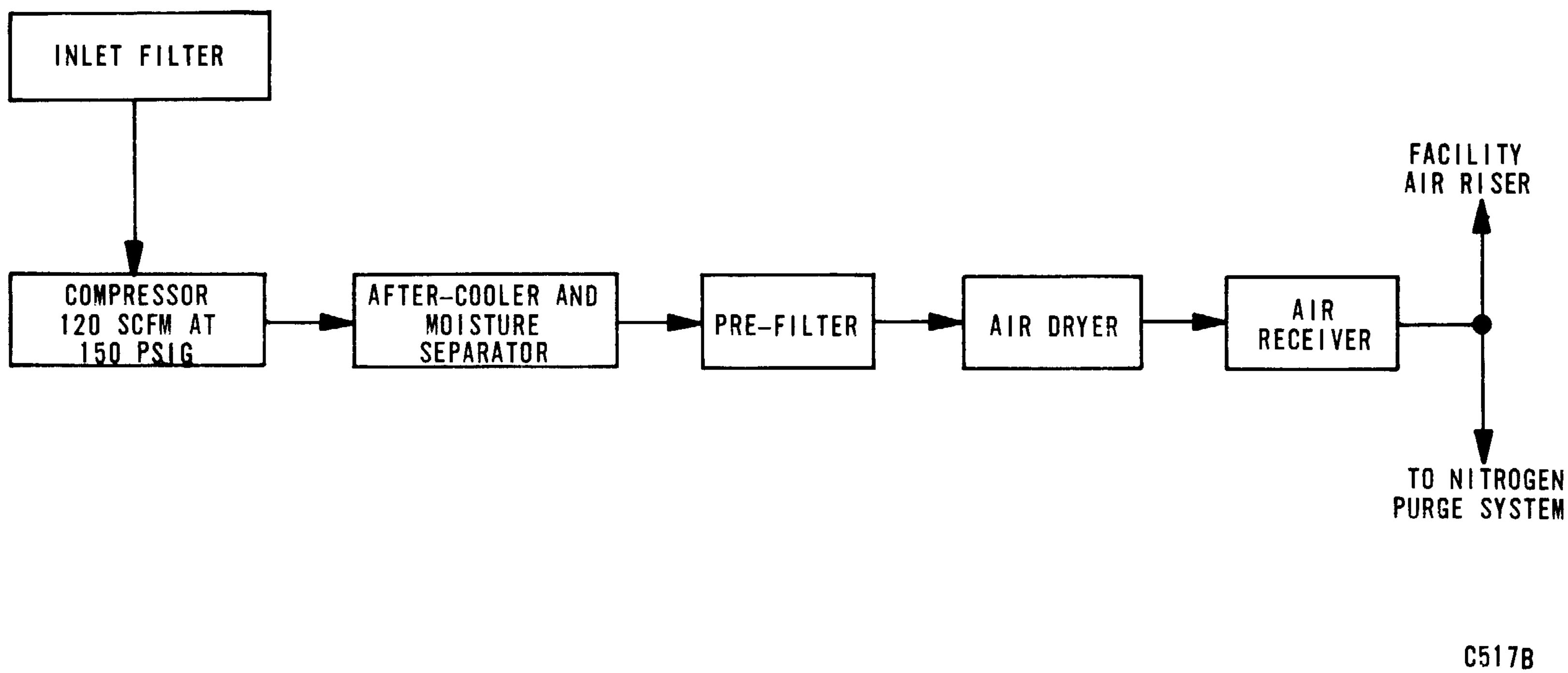


Figure 2-60. Mobile Service Structure Compressed Air System

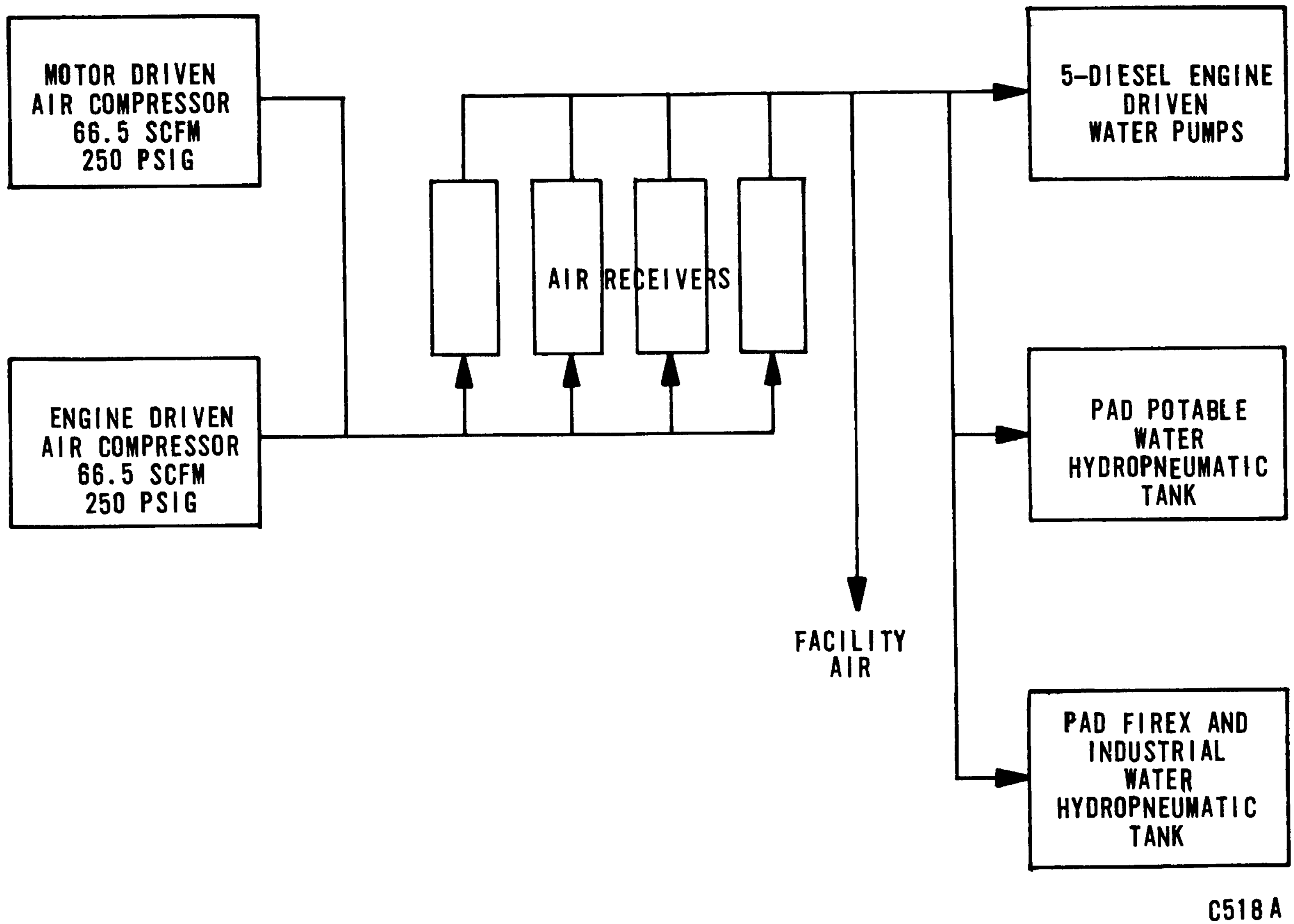


Figure 2-61. Launch Pad Water Pumping Station Compressed Air System

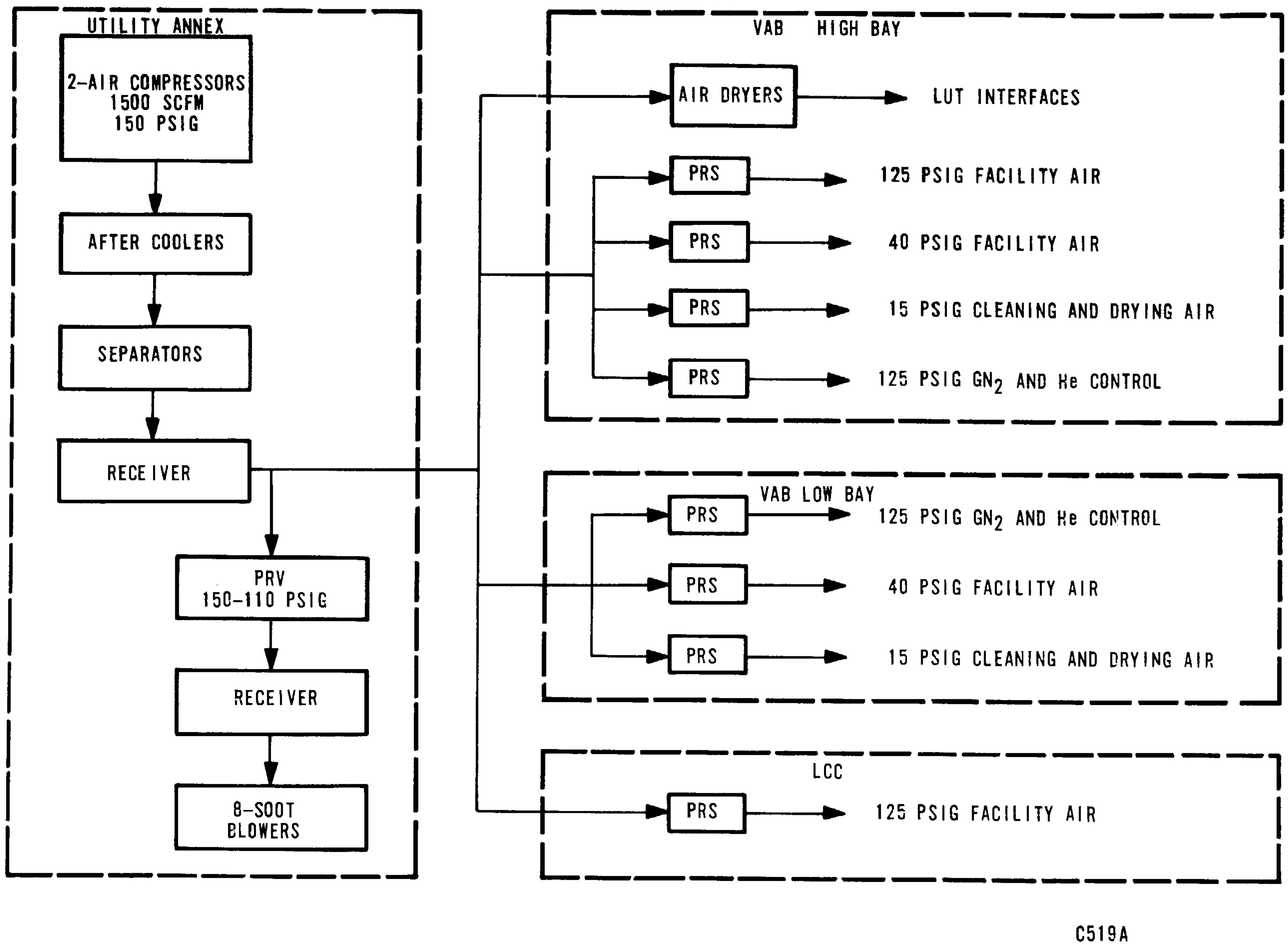


Figure2-62. Vehicle Assembly Building Compressed Air System

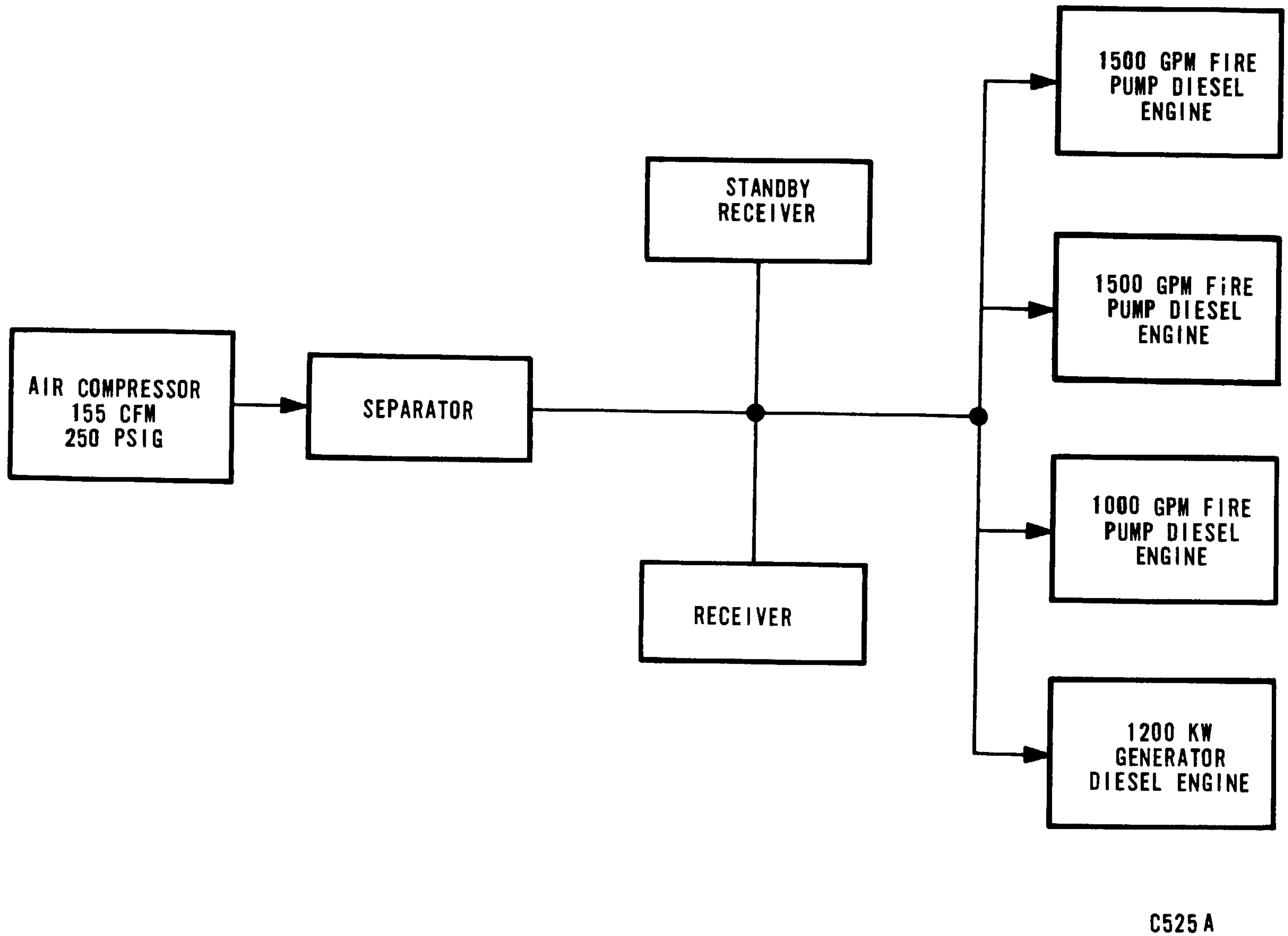


Figure 2-63. Utility Annex, Diesel Engine Start Compressed Air System

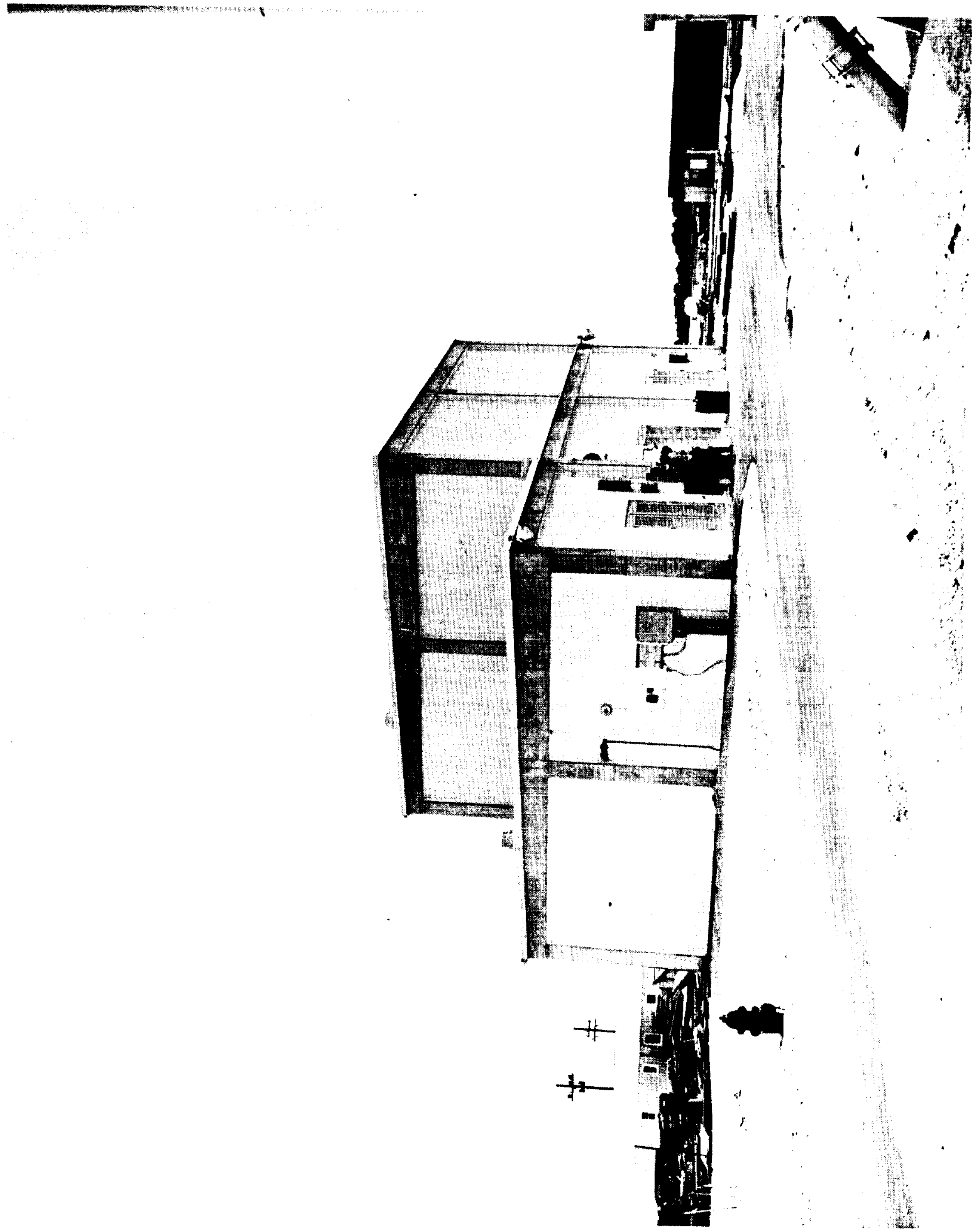


Figure 2-64. Paint and Oil Storage Building

2.11.11.1 Launch Pad. Compressed air at the launch pad (Figure 2-58) is provided from the Compressed Air Building. It furnishes clean, dry compressed air to the LUT while the LUT is located at the pad. There are no outlets from the system other than the LUT connection.

2.11.11.2 Launch Umbilical Tower. The LUT is supplied compressed air (Figure 2-59) from the launch pad interface. Compressed air is used for pneumatic valve control and for facility purposes.

2.11.11.3 Mobile Service Structure. The Mobile Service Structure Compressed Air System (Figure 2-60) delivers clean, dry air for use as facility air and as an alternate to nitrogen in purging hydraulic reservoirs and electrical enclosures.

2.11.11.4 Pad Water Pump Station. The Pad Water Pump Station Compressed Air System (Figure 2-61) furnishes air for starting the diesel-driven water pumps, for station facility air, for pressurizing the pad fire water and pad firex hydropneumatic tank, and for pressurizing the pad potable water hydropneumatic tank.

There are two air compressors. One is electric motor-driven and one is diesel engine-driven. They operate at 250 psig. Each is designed to have the capacity to fill four 30-inch diameter by 8-foot high receivers from 180 psig to 250 psig in 15 minutes.

2.11.11.5 Utility Annex. The Utility Annex Compressed Air System furnishes clean, dry air to the LCC, VAB, and Utility Annex. There are two systems. One is for plant air and the other is for diesel engine-starting.

One system furnishes air to the VAB high bay (Figure 2-62) for use on the LUT for valve control in gaseous nitrogen and helium pressure reduction stations, for facility air purposes at 125 psig and 40 psig, and for cleaning purposes at 15 psig. Air is used in the low bay for facility air at 40 psig, and for cleaning purposes at 15 psig. Air is used in the LCC for facility purposes at 125 psig. Air is used in the Utility Annex for soot blowing. The other system provides compressed air for starting the diesel engine (Figure 2-63), driving the emergency generator and the three fire pumps.

2.11.11.6 RP-1 Foam Generator. This system consists of a one-quarter HP blower which supplies air for firefighting foam. The system is located at the pad RP-1 storage area.

2.12 PAINT AND OIL STORAGE BUILDING (K6-996)

2.12.1 FUNCTION. The Paint and Oil Storage Building (Figure 2-64) provides a safe location for the storage, dispensing, mixing, and processing of paints, oils, dopes, chemicals, bottled gases, and similar flammable explosive or toxic materials in support of specific operational maintenance, or similar industrial processing-type activities at LC-39.

2.12.2 LOCATION. The Paint and Oil Storage Building is located west of the VAB.

2.12.3 DESCRIPTION. The building is a reinforced concrete frame structure with concrete block walls approximately 64 feet by 34 feet with a built-up gravel roof over rigid insulation on a concrete slab roof. The structure is basically divided into two functional areas; the Paint and Oil Storage Room and the Chemical Storage Room. This building is mechanically ventilated.

2.13 LAUNCH EQUIPMENT SHOP

2.13.1 FUNCTION. The Launch Equipment Shop (Figure 2-65) provides technical support for the fabrication and repair of launch support equipment.

2.13.2 LOCATION. The shop is located at LC-39 south of Saturn Causeway.

2.13.3 DESCRIPTION. The facility is housed in a building containing approximately 26,300 square feet. The shop has the capability for painting, machine shop work, sheet metal work, electronics, welding, woodworking and plastics fabrication, printed circuit fabrication, and pneumatics panels and hose fabrication.

2.14 SEWAGE TREATMENT PLANT (K6-792)

The Sewage Treatment Plant (Figure 2-66) is located west of the VAB and is designed for 1,200 persons with provisions to double the capacity.

This plant provides secondary treatment using an activated sludge wet burning process.

2.15 REPEATER STATION (K6-1193)

2.15.1 FUNCTION. This facility serves as a distribution center for communications and wideband circuits for LC-39 and facilities located in the northern part of KSC. This repeater feeds directly to the Central Telephone Office via underground cables.

2.15.2 LOCATION. The facility is located near the VAB on Kennedy Parkway North.

2.15.3 DESCRIPTION. The repeater station is a 5,250 square foot concrete block structure containing a communications equipment room, a mechanical equipment room, a boiler room, and restroom facilities. Beneath the building are two vaults; one for audio cables, the other for video cables.

Figure 2-65. Launch Equipment Shop

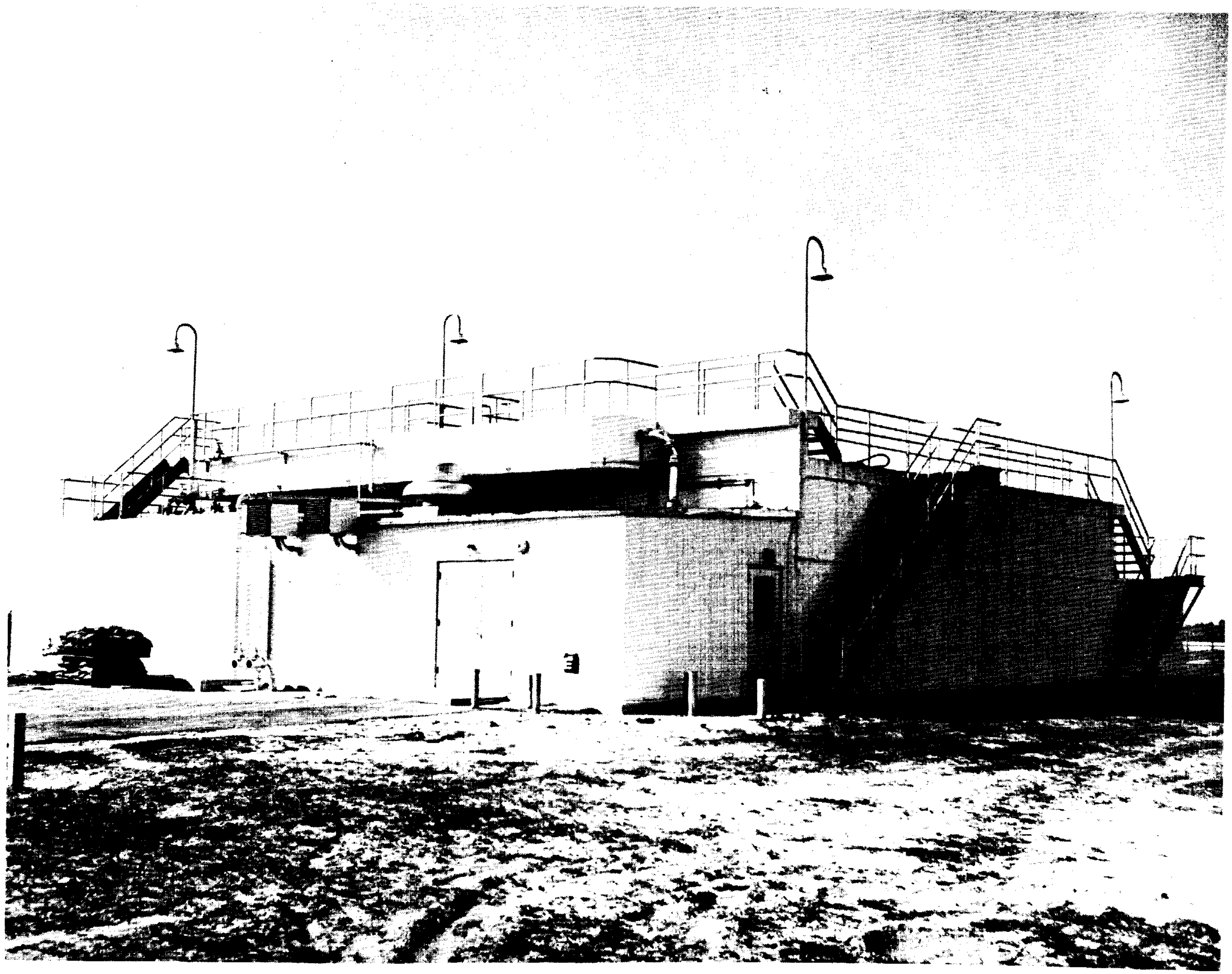


Figure 2-66. Launch Complex 39, Assembly Area Sewage Treatment Plant

DISTRIBUTION LIST (K-V-012)

This is the initial distribution at date of printing. If changes in distribution are required, contact Saturn Systems Office, DG.

Dr. K. Debus	AA
Mr. A. Siepert	AB
Mr. W. Murphy	CA
Mr. R. McDaris	EA
Mr. J. Shinkle	DA
Mr. J. Wooten	DB
Mr. R. Body	DD
Lt. Col. D. Scheller	DE
Mr. B. Greenglass	DE
Mr. E. Mathews	DG (5)
Mr. H. McCoy	DJ
Mr. E. Bertram	DK
Mr. R. Petrone	HA (2)
Mr. R. Moser	HC
Dr. H. Gruene	JA (7)
Mr. J. Williams	KA (6)
Col. A. Bagnulo	MA
Mr. J. Burke	MB
Mr. T. Poppel	MD
Mr. D. Buchanen	MG
Mr. J. White	ME
Mr. G. Williams	MJ
Mr. R. Dodd	MF
Mr. C. Wasileski	MH
Mr. R. Snetzer	MK
Mr. R. Clark	NA (5)
Mr. K. Sendler	PA (7)
Mr. R. Gorman	QA (6)
Mr. K. O'Keefe	RA (2)
Mr. C. Buckley	RD
Mr. J. Atkins	RE
Mr. R. Daley	RF
Mr. R. Ingles	RH-141 (3)
Mr. R. Cramer	RJ

KSC Library-Documents
RC432 (36)

Manned Spacecraft Center
Houston, Texas
BM-6 (3)

Marshal Space Flight Center
Huntsville, Alabama
MS-12 (3)

Goddard Space Flight Center
Greenbelt, Maryland
MFOD Library (3)

Scientific and Technical Information Facility
P. O. Box 33
College Park, Maryland
Attn: NASA Representative (2)

Bendix Corporation
Launch Support Division
BOD Building (BEN-ADM)
Attn: Mr. S. Kershner (5)

Boeing Company
8810 Astronaut Blvd
Cape Canaveral, Florida (5)

General Electric Company
Apollo Support Department
P. O. Box 7011
Cape Canaveral, Florida
Attn: Mr. G. C. Calleson (20)

International Business Machines
1615 North Atlantic Avenue
Cocoa Beach, Florida
Attn: Mr. A. G. Bellman (5)

North American Aviation
5505 North Atlantic Avenue
Cocoa Beach, Florida
Attn: Mr. J. L. Pierce (5)

Trans World Airlines
100 South Washington Avenue
Titusville, Florida (5)